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EDITOR

Howard P. Doub, M.D.
Detroit, Michigan

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The Pathology of Rheumatic Diseases[1]

D. MURRAY ANGEVINE, M.D.

Madison, Wis.

THIS DESCRIPTION of pathology of joints, tendons, and bursae has been prepared as a preliminary to a discussion of irradiation therapy in certain diseases of these structures. Accordingly the subject will be treated in its broadest aspects, with special stress on pathogenesis. It should be emphasized that such an elucidation is greatly hampered by our almost complete lack of knowledge of etiology. An entirely satisfactory or accurate classification cannot be given on a pathological basis without some consideration of etiology. The criteria for diagnoses of most rheumatic diseases are primarily clinical, with secondary consideration being given to the pathological lesions. As our knowledge of this comparatively neglected group of diseases increases, it is probable that more attention will be given to this phase of the subject. In the description to follow, rheumatic fever and tuberculosis will not be considered in any detail.

NORMAL ANATOMY

While it is not the purpose of this paper to discuss anatomy at any great length, certain significant features of structures to be mentioned subsequently will be described. We are primarily concerned with (*a*) the synovial membrane and villi of joints, the synovial lining of tendons and bursae, and (*b*) the articular hyaline cartilage. The former structure, namely synovial membrane, is of great importance and is the tissue primarily involved in most of these diseases, whereas the cartilage is highly important in degenerative joint disease or osteoarthritis.

The inner lining of the articular capsule, or *synovial membrane*, is smooth, glistening, and of a gray-yellow color. It is reflected over tendons that pass through joint spaces and ceases at the margins of the articular cartilages. It is composed of thin, delicate connective tissue and covered on its free surface by a layer of mesothelium. In certain joints, especially the knee, there are numerous foldings or reduplications of this membrane which are not considered as true synovial villi. Synovial villi are observed with difficulty by the unaided eye. If a joint be opened and submerged under water or saline, the villi float and are readily seen. They are usually slightly polypoid, being narrower at the point of attachment; they frequently branch and are most numerous in the region of the perichondrium, where synovial membrane and cartilage meet. There is a rich capillary network over the entire surface that is easily seen with slight magnification.

Articular cartilage is composed of cartilage cells enmeshed in a fibrillary matrix. The superficial cells are flattened and

[1] From the Department of Pathology, University of Wisconsin Medical School, Madison, Wis. Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

parallel to the surface, whereas the deeper ones are oval and arranged in vertical rows so that there is a tendency to split in a vertical direction.

CLASSIFICATION

A most satisfactory and desirable classification of joint diseases at present is that of the American Rheumatism Association, an abbreviated form of which follows:

Acute Infections of Known Etiology
Staphylococcus, Streptococcus, Gonococcus, Meningococcus, etc.
Chronic Infections of Known Etiology
Syphilis
Tuberculosis
Probably Infectious (Etiology Not Known)
Rheumatic fever
Rheumatoid arthritis (proliferative or atrophic)
Marie-Strümpell spondylitis
Still's disease
Degenerative Joint Disease or Osteoarthritis

It seems essential that in so far as possible the clinician, roentgenologist, and pathologist should use a similar terminology not only for this group but for all diseases. As roentgen studies and laboratory procedures come into wider and more universal use, the necessity for common terminologies and similar classifications is increasingly evident. Considerable progress in this direction was made during the war, when specialists from numerous localities were brought together, subjects discussed, and ideas exchanged.

ACUTE INFECTIONS OF KNOWN ETIOLOGY

When organisms such as the gonococcus, meningococcus, or one of the pyogenic bacteria lodge in a joint, they are usually carried by the blood stream from an infectious process elsewhere. There is frequently an increase in synovial fluid, the cytology of which reflects closely the type of inflammatory exudate in the synovial membrane. Observations on experimental arthritis in animals at various time intervals give a clear indication of the sequence of events. Such lesions can be readily produced by intravenous injections of hemolytic streptococci or other organisms (1). The first gross evidence of inflammation is a dilatation of vessels of the synovial membrane. On microscopic examination the villi are edematous and there is a moderate infiltration of the synovial tissue with polymorphonuclear leukocytes and lymphocytes, depending upon the virulence and number of the infecting organisms. Such a lesion may subside and heal, become purulent and produce a pyoarthrosis with destruction of cartilage, or may follow a comparatively chronic course from the time of onset.

From other experimental observations (2) it is believed that the anatomic structure of the synovial villus is a significant factor in localizing microorganisms in joints.

It is evident that in clinical cases the degree of involvement of the joint may vary considerably in different infections, depending upon the number and virulence of the infecting organisms. In the final analysis, the diagnosis depends upon the isolation of the etiologic agent from the synovial tissue or fluid.

CHRONIC INFECTIONS OF KNOWN ETIOLOGY

Tuberculosis is the most important of the chronic infections of known etiology. It usually involves the synovial membrane, and the extensive degenerative changes in cartilage are secondary to extensive pannus formation. Syphilitic arthritis is a rarity if it does occur.

PROBABLY INFECTIOUS (ETIOLOGY UNKNOWN)

Rheumatic Fever: In rheumatic fever the joints are involved for relatively brief periods; effusion, if present, rapidly subsides, usually leaving no residual. The inflammation in the synovial membrane is granulomatous and characterized by degeneration of collagenous tissue and a monocytic infiltration. Subcutaneous nodules appear about joints and at sites of pressure; certain histological similarities

to those of rheumatoid arthritis have been observed (3). The histopathology of subcutaneous nodules from both diseases has been described in detail by Bennett, Zeller, and Bauer (4).

Rheumatoid Arthritis: This disease most frequently involves the small joints of the hands, then spreads centripetally to the larger joints. Involvement is frequently bilaterally symmetrical but not necessarily so. The first observable change is a periarticular soft-tissue fusiform swelling, usually of the midphalangeal joints of the fingers. This is caused largely by inflammation and edema of the synovial membrane and subsynovial tissues, which become thickened. There is frequently effusion into the joint space, and aspirated fluid often contains large numbers of polymorphonuclear leukocytes. The lesion may subside and recur or may be progressive, in which instance the membrane is greatly thickened and the villi are enlarged; both are extensively infiltrated with large numbers of cells, chiefly lymphocytes, plasma cells, and monocytes. Many of the lymphocytes are arranged in foci, especially in the villi. The lining synovial cells are frequently several layers thick and occasionally covered by fibrinoid material. The walls of many medium-sized arteries in the subsynovial tissues are thickened and there is endothelial proliferation that narrows the lumen. As one seldom if ever has an opportunity to observe these vessels early in the disease, it is difficult to evaluate the significance of these alterations. It appears most probable that they are secondary to the inflammatory process in the synovial membrane, where many of the small arterioles frequently show hyalinization. This histologic picture is consistent with a clinical diagnosis of rheumatoid arthritis but will not establish the diagnosis.

The next significant change is a proliferation of the fibrous connective tissue in the region of the perichondrium. This vascular fibrous tissue, known as a pannus, grows over the surface of the articular cartilage and interferes with its normal nutrition, resulting in subsequent degenerative changes. When the pannus proliferates extensively, it fuses with the pannus on the opposite articulating surface to produce a fibrous ankylosis. While these changes are taking place in the joint proper, certain important alterations occur elsewhere. The muscles about the joint atrophy from disuse. There is also atrophy of the bone trabeculae in the ends of the bones adjacent to affected joints. One occasionally observes, also, a fibrosis, as well as a chronic inflammatory cellular exudate, in the intertrabecular spaces adjacent to the articular surfaces.

Subcutaneous nodules, usually periarticular, are frequently observed in this disease. Their chief characteristics are areas of fibrinoid degeneration surrounded by monocytic cells arranged in a palisade fashion. Attention has recently been focused on rather widespread inflammatory changes involving peripheral nerves (5) and voluntary muscles (6). Baggenstoss and Rosenberg (7) have also described changes in the heart which they attribute to rheumatoid arthritis. These observations are of considerable interest and require more extensive investigation. They indicate that this disease is widely disseminated and, although joint involvement is apparently the primary lesion, it is entirely possible that it may be only one important manifestation of a widespread process.

Marie-Strümpell Spondylitis: This disease is considered by most authorities to be a form of rheumatoid arthritis of the spine, involving the axial in contrast to the appendicular skeleton. The fact that it almost exclusively affects young male adults seems to indicate that it is a different disease; however, further clarification of this point must depend on information yet to be obtained. The initial involvement is an inflammation of the synovial membrane of the costovertebral articulations, and there is a similar involvement of the sacroiliac joints. As the disease progresses, there is an ankylosis of these joints that explains the symptoms and signs.

Studies of the early pathological changes are not available and probably will not be because of the nature of the disease. Biopsy material from the involved joints would be of considerable value and interest.

Still's Disease: This is a disease of children that is also considered as a form of rheumatoid arthritis (8), at least until additional adequate evidence is obtained to warrant a further separation from this group. The important features are lymph node enlargement, usually of the cervical, axillary, and inguinal groups. Microscopic examination of the enlarged nodes reveals hyperplasia. There is usually splenic enlargement, frequently due to amyloid infiltration. Fibrinous and fibrous pleurisy and pericarditis are common. The heart is often enlarged and verrucae have been described on the tricuspid and pulmonary valves. The usual lesion in the joints is a fusiform swelling progressing to deformity. Early in the course there are pain, swelling, and stiffness of the joints. As the disease progresses, the hands present a picture very similar to that characteristic of rheumatoid arthritis in adults, that is, flexion of the proximal phalangeal joints. Hyperextension of the distal phalanges is an important feature. Histologic sections show proliferation of synovial cells and an extensive chronic inflammation throughout the synovial membrane. The blood vessels are numerous, thin-walled and dilated in the early cases. Deformities appear relatively early in children and are usually accompanied by extensive demineralization of bone.

DEGENERATIVE JOINT DISEASE

The term degenerative joint disease has been advocated by Bauer and Bennett (9) in preference to osteoarthritis, and is more desirable. The disease is initially one of degeneration of cartilage. Several important factors may influence the onset. The most important seems to be wear and tear over and above what is normal for any given joint. The vascular supply about the margin of articular cartilage also gradually decreases with increasing age.

The first observable alteration in the cartilage is a slight flaking of the superficial layer; this is followed by fibrillation, which is a fraying or separation of the fibrillary tissue surrounding the cartilage cells. The cartilage cells show varying degrees of degeneration, and the articular cartilage stains irregularly due to deposition of mineral salts. As the lesion progresses, there is loss of cartilage, extending to the underlying bone in severe cases. When this occurs, there is a thickening of the underlying bone, which becomes smooth and very hard, like ivory, known as eburnation. There is some regeneration of cartilage, mostly at the periphery; this is possible because of the relatively rich vascular supply of the perichondrium. Rarefaction of bony trabeculae occurs when the disease is painful enough to cause disuse. Localized areas of rarefaction of bone have been variously attributed to islands of cartilage or to local osteoclastic resorption. It seems entirely possible that this may bear some relationship to alteration in the vascular supply of the bone. Osteophytes may arise from perichondrium and also from the fibrous tissue of the periosteum. Herberden's nodes that appear on the base of the terminal phalanges of the fingers are periosteal or tendon osteophytes arising in the extensor tendon at its point of attachment to the periosteum. They may become calcified or ossified. Changes in the synovial membrane are limited and may undergo hyperplasia and fibrosis due to mechanical irritation. Small cartilaginous nodules may form in synovial villi and give rise to loose bodies or joint mice.

ACUTE AND CHRONIC BURSITIS AND TENOSYNOVITIS

The lining membrane of tendons, tendon sheaths, and bursae is similar histologically to the synovial membrane. It is also fair to assume that it is probably functionally similar. In general, acute inflammation of these structures produces a

picture very similar to that described in the synovial membrane of joints. It is probably caused in most instances by a metastatic infection, trauma, or a combination of both. These structures are occasionally involved in rheumatic fever and rheumatoid arthritis. The chronic inflammatory lesions involving them, chiefly the bursae, probably begin with acute inflammation of the synovial lining, which may subside or continue as a chronic bursitis. Histologically the bursal wall is composed of dense fibrous tissue, the synovial lining composed of villous folds, and infiltrated with cells the character of which depends upon the severity and duration of the lesion. Synovial fluid is often seen between the villi. In chronic bursal lesions one frequently observes calcium deposits in the subsynovial tissue or the fibrous wall.

SUMMARY

The more significant lesions of joints, tendons, and bursae are briefly described, with special emphasis on inflammation of synovial membranes and the subsequent alterations produced by it. A description of the changes in the cartilage that occur in degenerative joint diseases is also given.

Department of Pathology
University of Wisconsin Medical School
Madison 6, Wis.

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SUMARIO

La Patología de las Afecciones Reumáticas

En esta breve reseña de las lesiones más importantes de las articulaciones, tendones y bolsas, recálcase en particular la inflamación de las membranas sinoviales y las alteraciones subsiguientes que la misma provoca. También se presenta una descripción de las alteraciones del cartílago que sobrevienen en la artropatía degenerativa.

En la clasificación de las enfermedades articulares, síguese, en forma abreviada, la de la Asociación Americana del Reumatismo:

Infecciones agudas de Etiología Conocida
  Estafilococo, Estreptococo, Gonococo, Meningococo, etc.
Infecciones Crónicas de Etiología Conocida
  Tuberculosis. Sífilis
Probablemente Infección
  Reumatismo (Fiebre Reumática)
  Artritis Reumatoidea
  Espondilitis de Marie-Strümpell
  Enfermedad de Still
Artropatía degenerativa (osteoartritis)

Roentgen Diagnostic Aspects of Chronic Arthritis and Bursitis[1]

LESTER W. PAUL, M.D., and WILLIAM W. MOIR, M.D.

Madison, Wis.

THE PURPOSE of the present communication is to evaluate the place of roentgen examination in the study of chronic joint disease, to correlate the clinical and roentgen aspects, and to demonstrate the pathologic alterations as they are revealed by roentgen study. The entire subject of chronic joint affections is one of such wide scope that it would be impossible to cover it fully in a single paper. Clinically the chronic arthropathies fall into three main groups: (1) chronic joint disease of more or less generalized nature, or at least affecting multiple joints, exemplified by rheumatoid arthritis and degenerative joint disease; (2) chronic arthritis limited to a single or, at the most, a few joints, represented by tuberculous arthritis, neurotrophic arthropathy, traumatic arthritis, gouty arthritis, and the secondary form of degenerative joint disease; (3) chronic disease limited to the periarticular tissues, the most common representative being the so-called subacromial bursitis and the related "frozen shoulder" of the clinician. We shall limit our discussion largely to lesions of the first and third groups, since these constitute the majority of chronic joint and periarticular affections and because, among these, will be found the lesions most amenable to roentgen therapy.

The terminology and classification of arthritis as recommended by the Committee of the American Rheumatism Association will be followed (7). While this is a clinical classification based in so far as possible upon etiology, with its terminology phrased to conform with the *Standard Nomenclature of Disease*, it can be adapted readily to roentgen practice.

It is obvious that roentgen examination is only one phase of the diagnostic study that patients with chronic joint disease should receive. Solely on a study of the roentgenograms it is not always possible to identify accurately the type of chronic arthritis that a patient may have. As Camp (2) has stated, "the roentgenologist, using only roentgenologic evidence, would have to classify the arthritides as (1) periarthritis, (2) atrophic arthritis, (3) hypertrophic arthritis, and (4) destructive arthritis." These are the fundamental alterations that can be detected in roentgenograms. Yet it would serve no useful purpose for roentgenologists to employ a classification different from that used by their clinical colleagues.

The value of roentgenologic examination in the early stages of chronic arthritis varies with the type of the disease. In rheumatoid arthritis the roentgen findings are not specific, and the early recognition of this disease is largely a clinical problem. The latent period before "characteristic" roentgen changes develop is usually a matter of months or even years. The same is true of the arthritis associated with gout. On the other hand, in degenerative joint disease (osteoarthritis) roentgen examination may reveal well defined changes in a joint which is clinically silent, or nearly so. It follows that a negative roentgenogram is of distinctly more value in excluding degenerative joint disease than it is in ruling out rheumatoid arthritis. In gouty arthritis, roentgenograms may not be diagnostic of the disease for years. The classical text-book picture of large, punched-out defects at the ends of the bones, gross disorganization of joint structure, and lumpy soft-tissue enlargements represents gouty arthritis in an advanced stage, years after its onset (5). The

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roentgen pattern of chronic arthritis also is often altered by the natural processes of repair. Thus a rheumatoid arthritic joint may show well marked "hypertrophic" changes if the disease in that particular joint has undergone periodic remissions or quiescence (Fig. 1). These factors must be kept in mind in any discussion of the roentgen features of chronic arthritis.

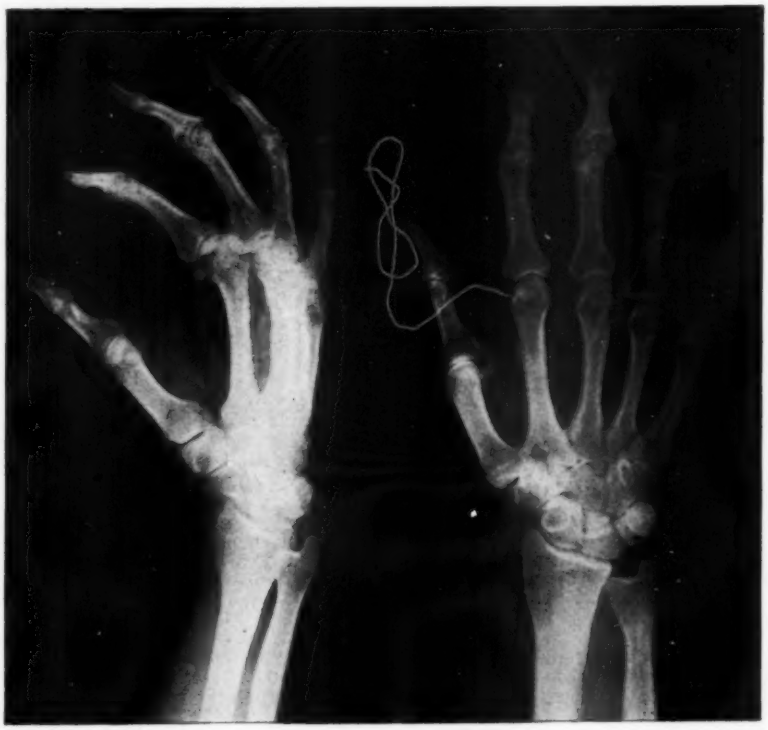

Fig. 1. Thirty-nine-year-old female. Clinical diagnosis, rheumatoid arthritis. Roentgenograms show severe involvement of the proximal interphalangeal joints with loss of joint space and pronounced bony proliferation at the proximal joint of the middle finger. In the other fingers the changes are more characteristic of rheumatoid arthritis, with narrowing of joint spaces, erosion of bony articular surfaces, and decalcification. The terminal joints are less severely affected.

RHEUMATOID ARTHRITIS

In the classification mentioned earlier, the term "rheumatoid" is favored over the synonyms "atrophic," "proliferative" and "chronic infectious arthritis." The infectious nature of the disease is considered very probable but remains to be proved. "Proliferative" refers to the pathologic changes in the synovial membrane and is likely to be confused with the bony proliferation which is a feature of degenerative joint disease. "Atrophic arthritis" has been favored by roentgenologists because atrophy is usually the major feature demonstrated on roentgen examination, but it does not cover adequately the pathological changes which have taken place.

While the clinical pattern of rheumatoid arthritis varies, most cases begin insidiously and run either a protracted and progressive course or undergo remissions of variable length. Eventually the disease leads to more or less crippling deformity of the affected joints. Typically, the peripheral joints are first affected, usually the proximal interphalangeal joints, with a tendency for a symmetrical distribution in the two hands. As the disease progresses,

it affects the more proximal joints, advancing toward the trunk in all extremities, until finally practically every joint in the body may be involved. A curious feature of the disease, for which there is no adequate explanation, is the frequent sparing of the terminal interphalangeal joints. Since the earliest lesions occur in the hands, may become extremely severe in advanced cases. These changes may be all that can be recognized for months, and in some joints the disease may never progress beyond this stage. Since these roentgen findings are not specific, the roentgenologist can only report periarticular swelling, or at the most periarthritis, even though the

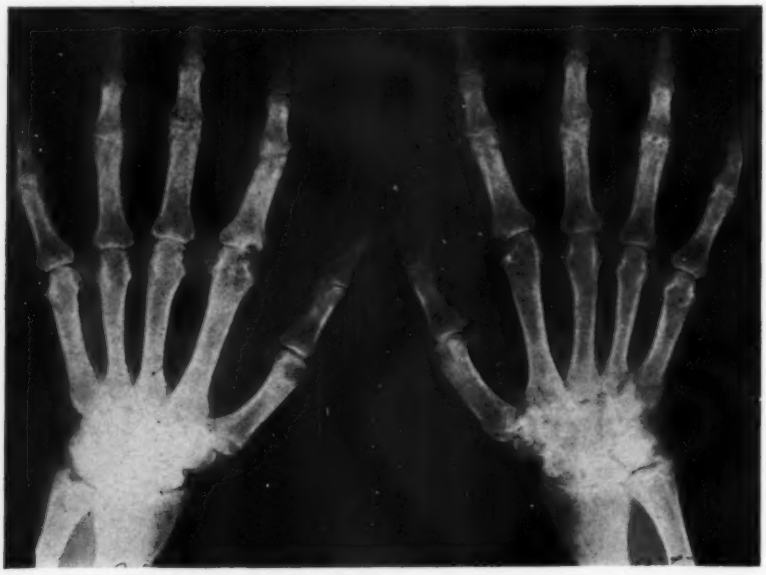

Fig. 2. Chronic rheumatoid arthritis of ten years' duration in a fifty-two-year-old female. The disease began in the proximal interphalangeal joints and later spread to the wrists, elbows, shoulders, ankles, and knees. Roentgenograms of the hands and wrists show many stages of rheumatoid arthritis in the different joints. Some of the proximal interphalangeal joints are beginning to ankylose. The terminal joints are essentially normal.

roentgen examination of these areas should be included in any study of chronic arthritis.

The first roentgen evidence usually is periarticular swelling, characteristically diffuse and fusiform. This is readily demonstrated in the proximal interphalangeal joints. Along with this, or after an interval of several months, decalcification of bone becomes apparent. Although the decalcification is at first limited to the articular ends of the bones near the affected joints, eventually the entire skeleton shows loss of density. This osteoporosis, which is one of the constant features of the disease and is aggravated by bodily disuse, multiplicity of joints involved, characteristic location, and symmetry of joints affected all point strongly to the diagnosis.

If the disease progresses, destruction of joint cartilage becomes apparent, as shown on the roentgenogram by narrowing of the joint space. This is generally uniform throughout the joint. In some joints, the articular ends of the bones remain smooth until the cartilaginous space completely disappears and bony ankylosis develops. More frequently they show irregular erosion with disappearance of the cortical shadow. This erosion may take the form of small "punched-out" defects. In other joints, it appears as a

fine roughening of the bony surface. All of these variations may be seen in a single hand and wrist (Fig. 2). The soft-tissue swelling tends to disappear in the later stages of the disease and is superseded by soft-tissue contractions, which in turn may lead to actual dislocation and severe crippling deformity. If the subluxation is pronounced, there is little tendency for bony ankylosis. The disease may become arrested at any stage. If this occurs before much structural change has been produced, the joint may return to a normal or almost normal appearance, the soft-tissue swelling disappearing and the bones regaining a normal density.

This is the usual and well recognized course of rheumatoid arthritis as it affects the peripheral joints. Many cases, however, differ in important respects. The disease may have an acute onset, it may begin originally in some of the larger joints rather than in the hands, or it may be limited to a few of these large joints. A small percentage of cases show an apparent clinical "cure." Variable amounts of hypertrophic bone reaction may develop as a manifestation of repair, and these hypertrophic features may eventually overshadow the atrophic in roentgenograms. Rheumatoid arthritis may also develop in a joint which has previously undergone degenerative changes, especially if the disease begins after middle age. It may be impossible from roentgen study to determine which is the primary disease when both hypertrophic and atrophic alterations are present. Such a lesion is likely to be classified as a "mixed" arthritis.

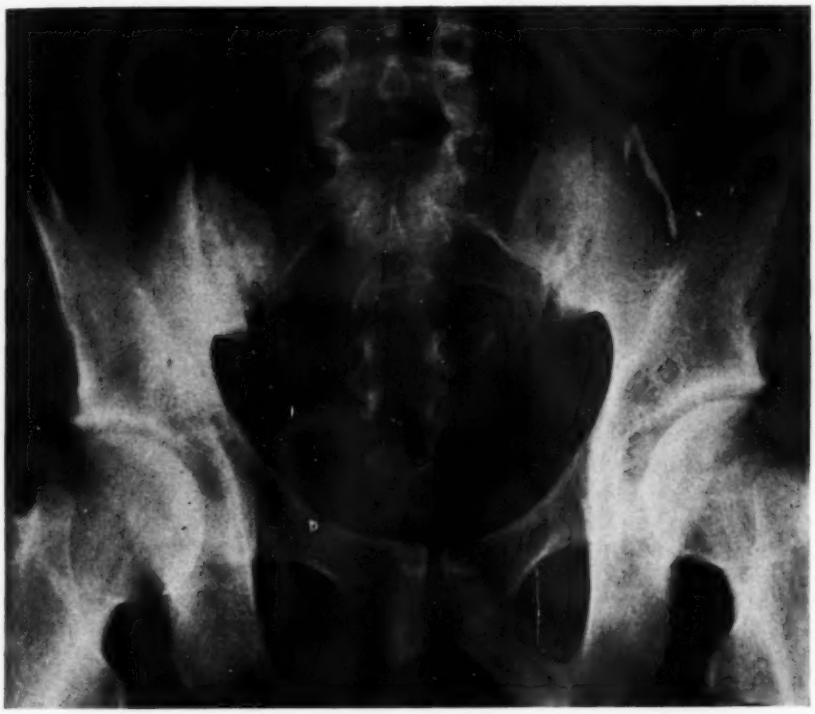

Fig. 3. Rheumatoid arthritis of the sacroiliac joints in a twenty-two-year-old male who has had intermittent low back pain, worse in damp weather, for the past seven years. The roentgen changes consist of blurred joint spaces, irregular joint margins, and some sclerosis.

Rheumatoid Arthritis of the Spine (Marie-Strümpell arthritis, ankylosing arthritis

of the spine, spondylitis rhizomélique, etc.): The numerous designations applied to this disease attest to the differences of opinion as to its nature and place in the classification of chronic arthritis. The cause is unknown, and while its relationship to rheumatoid arthritis of the peripheral joints is somewhat debatable, many competent investigators believe it should be classified as a form of rheumatoid arthritis (1, 3, 7). Affecting young adult males predominantly, it is one of the common causes of chronic back pain in that age group. The clinical onset is insidious. Roentgen changes may not become apparent until some months or even years after the beginning of symptoms. Characteristically, the earliest roentgen evidence appears in the sacroiliac joints bilaterally (Fig. 3). The articular surfaces lose their sharp outlines and the joints have a blurred appearance. Fuzzy sclerosis develops along the joint margins. As the disease advances, the bony margins show gross irregularities, followed in time by ligamentous calcification and finally bony ankylosis. The disease may remain confined to the sacroiliac joints, progressing through all stages, including bony ankylosis. More frequently, there is a slow progression throughout the spine. The facet joints undergo the same changes as occur in the sacroiliacs and finally ankylose. Not all facet joints are involved equally nor at the same time. Concomitantly, calcification in the spinal ligaments begins, and, in progressive cases, continues until a complete shell of calcification surrounds the vertebrae, the end result being the "poker spine" of the clinician. Ligament calcification may, however, be absent or minimal. In later stages, chronic decalcification of bone is a prominent feature.

For demonstrating the early changes, special projections may be necessary. A satisfactory visualization of the sacroiliac joints usually can be obtained by an anteroposterior projection with the roentgen tube angled 25 degrees toward the head. For the lumbar facet joints, oblique views are necessary. The dorsal facet joints cannot be shown satisfactorily in many cases. The best view of these is obtained with the patient's body rotated slightly off the true lateral.

Still's Disease: This disease of children is thought to be identical with rheumatoid arthritis in adults and needs no further discussion here.

DEGENERATIVE JOINT DISEASE

(*Degenerative Arthritis, Osteoarthritis, Hypertrophic Arthritis, Osteoarthrosis, etc.*)

Although the cause of degenerative joint disease is unknown, it seems well established that infection plays no part. Because of this, many investigators have disliked the use of the term arthritis. "Osteoarthrosis" has been suggested as a better designation. In this country, at least, "osteoarthritis" and "hypertrophic arthritis" seem to be preferred, the latter term being found frequently in the roentgenologic literature because it more aptly describes the changes seen in roentgenograms. "Degenerative joint disease" is given preference in the classification submitted by the Committee of the American Rheumatism Association, but in its discussion the term "osteoarthritis" is used.

When the spine is involved, a variety of descriptive terms have been employed. The joints between the vertebral bodies are not synovial joints and, if the term arthritis is to be limited only to joints covered by synovial membrane, changes occurring along the margins of the vertebral bodies (spurs) and in the intervertebral disks (thinning) cannot rightly be called arthritis. Marginal osteophytes on the vertebral bodies are almost a uniform finding after middle age. Generally these are designated as "hypertrophic changes" rather than "arthritis." In many, but not all, of these patients some degree of thinning of intervertebral disks also is present and the two processes undoubtedly are closely allied. Oppenheimer (6) believes that the marginal spurring is always the result of change in the intervertebral

disk and has suggested the term "discogenetic disease" to cover the condition. Certainly, "hypertrophic arthritis" seems a poor term to use unless there is involvement of the facet joints. Since all of these changes, *i.e.*, marginal spurring, thinning of disks, and osteoarthritic changes in the facet joints, probably are a part of the same process, and since the pathologic manifestations are primarily those of degeneration, it would appear that the entire gamut of these changes in the spine might well be covered by the term "degenerative joint disease of the spine."

In other joints, particularly the hip and knee, the term "hypertrophic" does not always fit either the roentgen appearances or the pathologic changes. As an example, in Figure 4 is shown the roentgenogram of a hip joint severely involved. There are loss of joint space, partial subluxation, sclerosis of bony articular surfaces, and large cystic spaces. All of the features of hypertrophic arthritis are present except bony hypertrophy in the form of marginal spurs, and these are almost entirely absent. This is the *malum coxae senilis* of the older terminology, the osteoarthritis of the present-day clinician, and the hypertrophic arthritis of the roentgenologist. "Degenerative joint disease" would seem a much better designation from all points of view. As mentioned earlier, in some cases of rheumatoid arthritis, reparative processes lead to considerable marginal spurring and, if such a joint becomes quiescent before bony ankylosis develops, it may mimic a hypertrophic joint almost completely.

It is convenient to consider degenerative joint disease as occurring in two major forms, primary and secondary. The primary form is a generalized disease affecting mainly the weight-bearing joints, the spine, and the terminal interphalangeal joints of the fingers, the cause of which is unknown. The secondary form develops in a joint that has been subjected to abnormal stresses and strains over a period of time or one that has been traumatized repeatedly. In the hip, it often follows

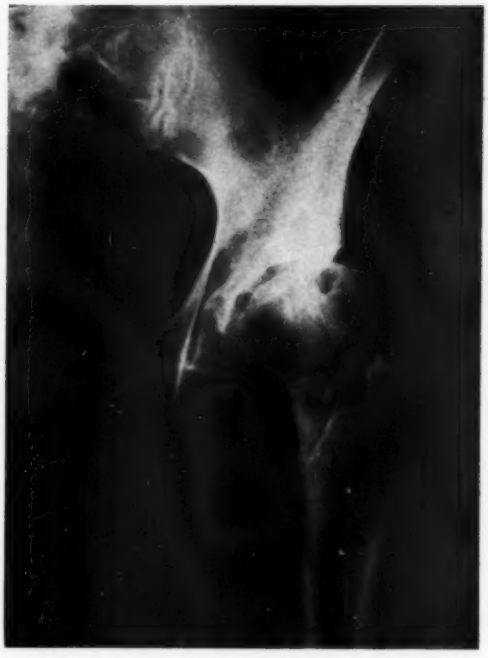

Fig. 4. Degenerative joint disease (osteoarthritis) of the hip in a fifty-year-old female who had a painful right hip for the past six years, with "sciatica." No other joints were affected. The roentgenogram shows narrowing of the joint space superiorly, increased density of the acetabular rim, "cyst" in the femoral head, slight subluxation, but little or no osteophyte formation. The head of the femur does not fit well in the acetabulum. This is an example of the secondary form of degenerative joint disease.

congenital abnormalities in the shape and form of the acetabulum or of the femoral head, Legg-Perthes' disease, epiphyseolysis, etc., or it may develop as a result of abnormal weight-bearing such as follows a shortening of one leg or a scoliotic deformity of the spine. The roentgen signs and pathologic changes are similar in the two forms, and the dividing line between them often is not distinct.

In the hands, involvement of the terminal interphalangeal joints is a characteristic of the primary form of the disease. Degenerative disease in other joints of the upper extremity rarely is a severe lesion, limited usually to marginal osteophyte formation. In the lower extremity, the hip and knee are affected most frequently, the ankle less so. In the foot, the metatarsophalangeal joint of the great toe is

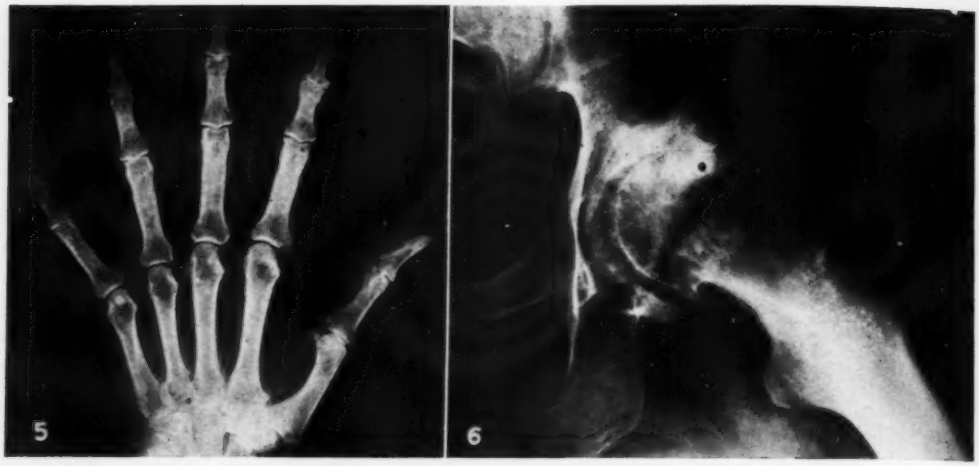

Fig. 5. Degenerative joint disease (osteoarthritis) of the fingers in a sixty-year-old female. The terminal joints of the fingers are affected chiefly, particularly of the index finger, which shows well developed Heberden's nodes.

Fig. 6. Degenerative joint disease of the hip (osteoarthritis) showing all of the characteristic features of moderately advanced disease.

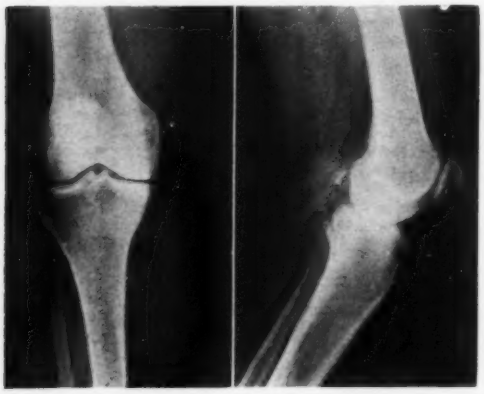

Fig. 7. Degenerative arthritis of minimal severity in a fifty-four-year-old female with primary complaints referable to the cardiovascular system. Slight narrowing of the medial part of the joint space, some increased density of articular surfaces on the inner side, small marginal osteophytes, and an irregular fabella.

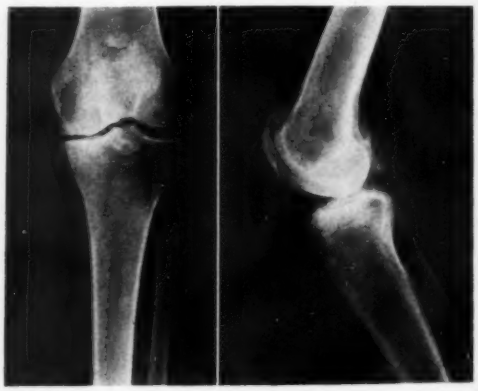

Fig. 8. Degenerative joint disease (osteoarthritis) of the knee. In addition to uneven narrowing of the joint space, there is a large spur on the anterior tibial articular surface, a bony loose body above the patella, and fluid in the joint pouch. The fabella is irregular and large.

most often involved. Changes also are relatively common in some of the intertarsal joints, particularly the astragaloscaphoid in patients with flat feet.

There is some difference in the roentgen appearances of the disease in the weight-bearing and non-weight-bearing joints. In the fingers the early findings consist of tiny marginal spurs or small calcific flakes along the bases of the distal phalanges. These enlarge gradually to form well defined bony protuberances which cause an irregular, knobby thickening, palpable and visible, representing the well known Heberden's nodes, one of the significant clinical diagnostic features of the disease (Fig. 5). In more severely affected joints, narrowing of the joint space is present, and the bony articular surfaces become quite irregular. This picture is somewhat

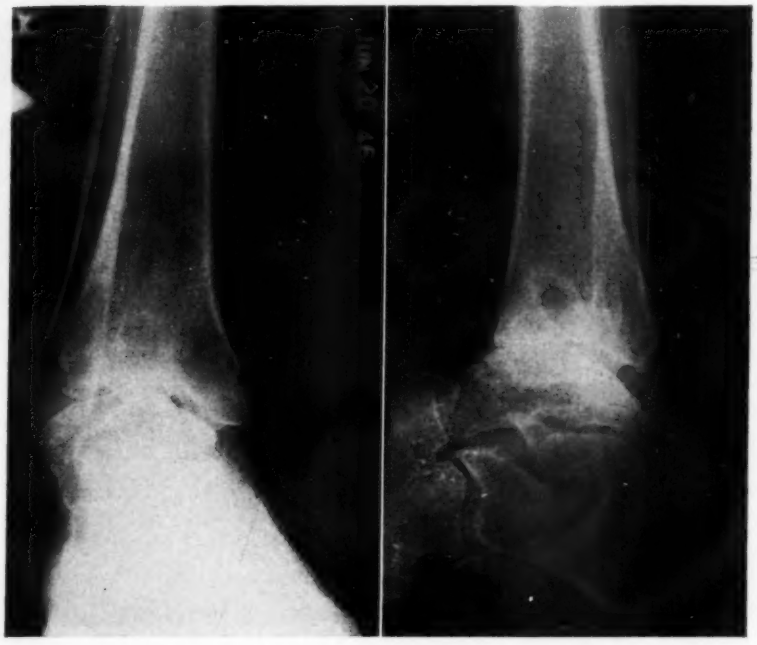

Fig. 9. Degenerative joint disease of the ankle developing secondarily to a congenital clubfoot deformity. The changes are similar to those seen in the hip and knee.

similar to that seen in rheumatoid arthritis. There are, however, no punched-out defects, and decalcification of the articular ends is not present. Bony trabeculae remain sharp, and a cortical margin may be apparent. The terminal phalanx becomes flexed on the middle, and the finger cannot be completely straightened. Partial subluxations may occur, but bony ankylosis is unusual. In some cases small cystic cavities develop in the ends of the bones, but eburnation of bones seldom is striking.

In the hip, the early signs of this disease vary. In some, the first evidence consists in increased density along the superior acetabular rim. In others, marginal spurring is the earliest feature, but in most cases narrowing of the joint space is the most significant finding. In contrast to rheumatoid arthritis, decrease in joint space in degenerative disease is characterized by its asymmetry and is related closely to the distribution of weight-bearing in the joint (Fig. 6). In the hip, this affects the superior portion almost exclusively, since this is the area which receives the thrust of the femoral head in weight-bearing. This narrowing progresses to complete loss of the joint space but without bony ankylosis. This asymmetrical narrowing of the joint space leads to varying degrees of subluxation of the femoral head and, if accompanied by a wearing away of the superior portion of the acetabular fossa, may result in notable deformity. Marginal osteophytes of large size may be present. As the head moves upward in the enlarged acetabular fossa, considerable amounts of calci m may be laid down along the under surface as if to fill more completely the enlarged cavity. The joint surfaces, particularly the acetabular, show increased density, although the bone actually is softer than normal. Cystic appearing cavities develop as sharply outlined rarefactions surrounded by dense sclerotic walls. In some cases the "cysts" appear quite early. Infrequently, degenerative disease in the hip may lead to a general

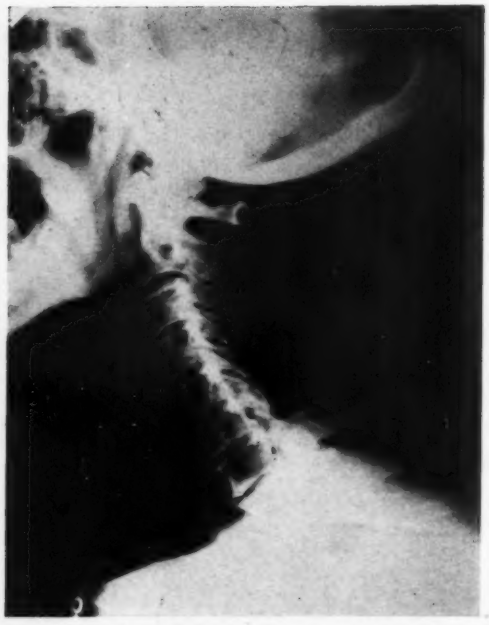

Fig. 10. Degenerative joint disease (osteoarthritis) of the cervical spine in a sixty-nine-year-old male complaining only of paresthesias in the right ulnar nerve distribution. Lateral roentgenogram shows narrowing of the lower cervical disk spaces, marginal osteophytes, and osteoarthritic changes in the facet joints.

deepening and inward bulging of the acetabular cavity, and some cases, at least, of so-called intrapelvic protrusion of the acetabulum seem to be due to this cause.

Degenerative joint disease is the most common chronic joint affection encountered in the knee. In most cases the early changes consist in the development of small spurs along the joint margins, on the tibial spine, along the borders of the intercondylar fossa of the femur, and on the articular edges of the patella. Hypertrophic excrescences may develop on the joint surface of the tibia, particularly at the attachments of the cruciate ligaments. As in the hip, narrowing of the joint space usually appears quite early and may be the first sign (Fig. 7). It is generally asymmetrical, with the medial aspect undergoing the most severe change. Increased density of bony articular surfaces also is most pronounced along the zone of greatest joint-space narrowing. Because of the uneven narrowing of the joint space and the consequent disturbance of weight-bearing alignment, some degree of lateral subluxation of the tibia on the femur is common in advanced lesions, and a varus deformity is frequent. In contrast to the hip, the formation of cystic cavities in the articular ends of the bones is rare. However, a common feature of the disease in this joint, and almost exclusively limited to it, is the development of calcific or bony loose bodies within the joint pouch (Fig. 8). The fabella, if present, is enlarged and roughened. Joint effusion is said to be uncommon in this type of disease, but roentgenograms of the knee often show evidence of fluid, and the examination may have been requested to determine the cause of such effusion. In some cases the occurrence of fluid is the chief reason for consulting the physician. It may be that the effusion is due to mechanical irritation from intra-articular loose bodies or to trauma in a joint rendered unstable by the disease.

Unless deformity of the foot is present, degenerative disease in the ankle usually is limited to marginal spurring and some condensation of bone along the articular surfaces. In the presence of stresses and strains due to faulty weight-bearing, the same progression of the disease may occur in the ankle as in the knee and hip (Fig. 9).

Degenerative Disease of the Spine: The same process that involves the peripheral joints also may affect the spine, but because of anatomical structures peculiar to this region it requires separate discussion. The most common finding, almost universally present in patients above middle age, is hypertrophic spurs along the anterior and lateral margins of the vertebral bodies. These marginal osteophytes are particularly prone to develop in the lower cervical, the lower dorsal, and the lower lumbar areas. When the process begins in younger persons, below the age of fifty, the lower cervical vertebrae often are affected primarily. In addition to the spurs, small calcific or bony deposits

may form in the spinal ligaments, especially the anterior, without any attachment to the adjacent bodies. Bony proliferation along the margins of the spinous processes often is present, as is marginal spurring of the costovertebral joints. In the more severe forms of the disease, some degree of thinning of the intervertebral disks is found (Fig. 10). This is particularly likely to occur in the lower cervical region and at the lumbosacral joint, but other disk spaces may be affected. Narrowing of the disk space usually is uniform except in the dorsal region, where it is most pronounced along the anterior borders. In the presence of scoliosis, these changes are more marked along the concave side of the curvature.

Because this disease is found chiefly in the older age period, senile decalcification of bone usually is present, although the cortical margins of the vertebrae remain distinct and actually may show increased density. Involvement of the facet joints may or may not be present. When it is, the roentgen findings are no different from those seen in other weight-bearing joints, allowing for differences in size of the joints. These changes consist in narrowing of joint space, marginal spurring, increased density of bony articular surfaces, and slight degrees of subluxation, the uppermost facets slipping downward on the ones below. This, combined with the thinning of the adjacent intervertebral disk, may result in distinct narrowing of the corresponding spinal foramina. Marginal spurs are not infrequent on the posterior margins of the vertebrae in the lower cervical and lower lumbar areas. These are more significant from a clinical standpoint than spurs on the other surfaces, because of the close association with the spinal nerve roots.

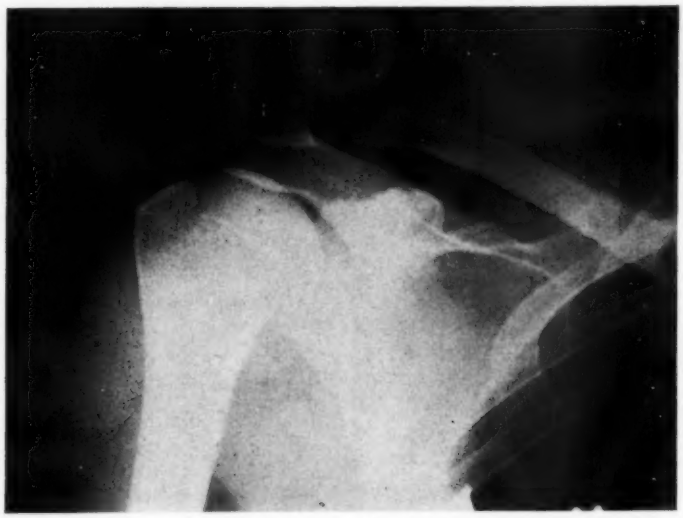

Fig. 11. Subacromial bursitis. Amorphous calcified deposit probably in the supraspinatus tendon.

PERIARTICULAR DISEASE

The various forms of periarticular rheumatic disease are of relatively little interest to the roentgenologist, with the exception of lesions about the shoulder, since roentgen findings usually are negative except for periarticular swelling. In the shoulder, periarticular disease is the commonest affection encountered by the clinician. According to Comroe (3), this accounts for 85 to 90 per cent of all complaints in this region. Calcification in the soft tissues about the joint, chiefly the supraspinatus

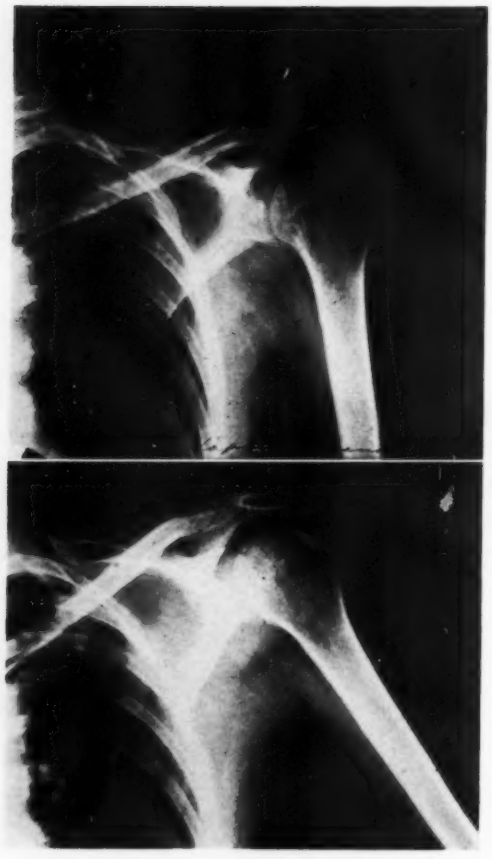

Fig. 12. Contracted shoulder in a fifty-year-old female who complained of gradually increasing stiffness of the left shoulder of six months' duration. The top roentgenogram shows the shoulder joint with the arm in neutral position. The lower roentgenogram was made with the arm in maximum abduction and internal rotation. Very little motion is demonstrated between the humerus and scapula, the patient being able merely to elevate the shoulder. Usually a third view also is made, with the arm in abduction and external rotation. These three views are useful in the routine study of the shoulder area.

tendon, is found in about 50 per cent of patients suffering from chronic periarthritis of the shoulder (Fig. 11). In the remainder, excluding those with posttraumatic residues, such as avulsion of the greater tuberosity of the humerus, the roentgen findings are limited to disuse decalcification of the bones and evidence of soft-tissue contracture of variable degrees. Solely on the basis of roentgen examination it is not possible to determine whether the calcification is within the bursa or in the tendons. Such calcification can be distinguished from fracture fragments by the homogeneous character of the shadow or shadows and absence of a corresponding defect in the adjacent bone. Special projections may be necessary to demonstrate the calcified deposits. These also are useful in showing the amount of limitation of motion that may be present and serve as an excellent record of such disability when it is desired to follow the results of treatment (Fig. 12).

SUMMARY AND CONCLUSIONS

Rheumatoid arthritis and degenerative joint disease (osteoarthritis) account for the majority of chronic disabling joint affections except in the shoulder. In that area, periarticular disease, variously labeled as periarthritis, subdeltoid or subacromial bursitis, chronic adhesive bursitis, etc., is the most common cause of disability.

In early rheumatoid arthritis, roentgen changes usually are limited to periarticular swelling, and this is not specific for the disease. While the clinical course and the associated changes seen in roentgenograms generally follow a fairly characteristic pattern of progression, variations do occur with sufficient frequency to make the diagnosis difficult at times. Characteristically the roentgen changes develop in an orderly manner, beginning with soft-tissue swelling, followed progressively by bone decalcification, narrowing of joint space, erosion of the articular ends of the bones, soft-tissue contractures, and bony ankylosis or gross subluxation. The disease, however, may be arrested at any stage, may progress more rapidly in some joints than in others, or may follow an atypical pattern of joint involvement.

The same variations are encountered in rheumatoid arthritis of the sacroiliac joints and the apophyseal joints of the spine.

Degenerative joint disease (osteoarthritis) often produces well advanced roentgen findings before the onset of clinical complaints. The disease may be

more or less generalized, affecting particularly the terminal interphalangeal joints of the fingers, the spine, and the large weight-bearing joints of the lower extremities. In the spine, the roentgen findings include changes on the vertebral bodies (spurring), in the intervertebral disks (thinning), and in the apophyseal joints. All of these appear to be related processes. In the weight-bearing joints, especially the hip and knee, degenerative disease may develop as a result of long continued stresses due to abnormal weight-bearing. The roentgen changes are similar to those seen in the generalized form of the disease and consist in narrowing of the joint space at the site of greatest weight-bearing thrust, increased density of the articular ends of the bones, marginal osteophyte formation, and cystic rarefactions in the bony articular surfaces or close to them.

In the shoulder, chronic periarticular disease accounts for the majority of disabling affections, the lesion usually being a bursitis, a tendinitis, or both. Calcified deposits in the tendons will be found in about half of these cases, the others showing only chronic decalcification of the bones and soft-tissue contractures. Calcified deposits also are found in patients without complaints referable to the shoulder, so that visualization of such deposits in roentgenograms does not necessarily indicate an active inflammatory process.

1300 University Ave.
Madison, Wis.

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SUMARIO

Consideraciones sobre el Diagnóstico Roentgenológico de la Artritis y la Bursitis Crónicas

La artritis y la artropatía degenerativa (osteoartritis) reumatoideas comprenden la mayoría de las afecciones incapacitantes crónicas de las articulaciones, si se exceptúa el hombro, en el cual la causa más común de incapacidad radica en alguna afección periarticular, bautizada con los nombres de periartritis, bursitis subdeltoidea o subacrómica, bursitis adhesiva crónica, etc.

En la artritis reumatoidea temprana las alteraciones roentgenológicas suelen limitarse a edema periarticular, que no es específico para esta dolencia. Si bien la evolución clínica y las alteraciones radiográficas que la acompañan confórmanse por lo general a un patrón bastante típico de gravación también sobrevienen variaciones con suficiente frecuencia para hacer a veces difícil el diagnóstico. Característicamente, las alteraciones roentgenológicas aparecen con cierto sistema, comenzando con edema de los tejidos blandos, seguido gradualmente de descalcificación ósea, estrechamiento de los espacios articulares, erosión de los extremos articulares de los huesos, contracturas del tejido blando y anquilosis ósea o subluxación macroscópica. No obstante, la enfermedad puede estacionarse en cualquier etapa. puede avanzar más rápidamente en unas articulaciones que en otras, o puede seguir un patrón atípico de invasión articular.

Las mismas variaciones se observan en la artritis reumatoidea de las articulaciones sacro-iliacas o las apofisarias del raquis.

La artropatía degenerativa (osteoartritis) produce a menudo hallazgos roent-

genológicos bien avanzados antes de manifestarse síntomas. La enfermedad puede ser más o menos generalizada, afectando en particular las articulaciones interfalangianas terminales de los dedos de las manos, la columna vertebral y las grandes articulaciones de los miembros inferiores que sobrellevan el peso. En la espina dorsal los hallazgos radiológicos comprenden alteraciones en los cuerpos de las vértebras (espolones), en los discos intervertebrales (adelgazamiento) y en las articulaciones apofisarias. Todos estos procesos parecen hallarse enlazados. En las articulaciones que cargan el peso, sobre todo la cadera y la rodilla, puede presentarse artropatía degenerativa a consecuencia de esfuerzos continuados impuestos por cargas anormales. Las alteraciones radiológicas son semejantes a las observadas en la forma generalizada de la dolencia.

En el hombro, a las periartropatías crónicas corresponden la mayoría de las afecciones incapacitantes, consistiendo la lesión casi siempre en bursitis, tenonitis, o ambas. Aproximadamente en la mitad de estos casos se encontrarán depósitos calcificados en los tendones, mientras que los demás sólo muestran descalcificación crónica de los huesos y contracturas de los tejidos blandos. También se observan depósitos calcificados en enfermos que no tienen síntomas imputables al hombro, de modo que la visualización radiográfica de aquéllos no indica forzosamente la existencia de un proceso inflamatorio crónico.

Roentgen Therapy in Arthritis, Bursitis, and Allied Conditions[1]

ERNST A. POHLE, M.D., Ph.D.,[2] and JAMES A. MORTON, M.D.[3]

Madison, Wis.

THE pathological and radiodiagnostic aspects of arthritis, bursitis, and allied conditions have been discussed in detail in the two preceding papers, by Drs. Angevine and Paul (pages 1 and 6). This presentation will relate our experience with the therapeutic use of roentgen rays in these conditions. Roentgen therapy of arthritis is by no means new; since the history of this particular field has been dealt with by several authors (4, 7), suffice it to say that as early as 1898 the subject was mentioned in the French, German, Russian, Swedish and Swiss literature (10). As far as we could ascertain the first American authors dealing with it were Anders, Daland and Pfahler (1), who published a preliminary report of the treatment of arthritis deformans with roentgen rays in 1906. Their results were encouraging and they reached the conclusion that this method is a valuable adjunct in the treatment of these chronic joint affections. In the literature of the last twenty years, however, there are not many references to roentgen therapy of arthritis. This is surprising if one considers the importance of the condition as well as its high incidence. Our report is rendered from a strictly practical standpoint and in an effort to induce more radiologists to try the method in a large number of cases so that we may eventually arrive at its true evaluation.

CLINICAL MATERIAL

During the four-year period 1941–45 we treated 331 separate cases of rheumatoid and hypertrophic arthritis. Early in 1945 we decided to accept as many cases as possible for the present study. All patients were examined in the diagnostic section of our department and the extent of arthritic involvement was graded. One hundred consecutive cases of arthritis and allied diseases were taken from those treated that year. The results could thus be observed and recorded by the same physician, although it obviated the study of duration of response.

This group of patients is heterogeneous, consisting of state, clinic, and private cases, rural and urban. There was, however, a predominance of farmers, explaining the large number of severe cases of hypertrophic arthritis, a disease which appears to be aggravated by a lifetime of hard work. Ages were well spaced from forty to eighty years, the decade of sixty to seventy having the largest representation. All patients were seen by a member of another department, and many of them were sent to us by the Department of Orthopedic Surgery. All were interviewed by a member of the therapeutic section of our department and the extent of disability was recorded. No objective study was attempted except the taking of roentgenograms in all cases. About 70 per cent of the group were followed by personal interviews; the remainder by mail. Ninety-two cases were traced.

TECHNIC

While in general we do not believe in standardized technic for any one disease, yet most of our cases received essentially the same amount of therapy. We have available a 200-kv. (175 constant potential equivalent) and a 400-kv. machine, and while osteoarthritis is generally treated

[1] Department of Radiology, University of Wisconsin Medical School, Madison, Wis. Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1-6, 1946.

[2] Professor of Radiology, University of Wisconsin.

[3] Former Resident in Radiology, University of Wisconsin. Now radiologist, St. Joseph Mercy Hospital, Pontiac, Mich.

TABLE I: RESULTS OF ROENTGEN THERAPY IN OSTEOARTHRITIS AND ALLIED CONDITIONS

	Total Areas*	No Relief, %	Slight Relief, %	Moderate or Complete Relief, %
Osteoarthritis				
Spine				
Cervical	13	31.0	0	69.0
Thoracic	17	41.0	0	59.0
Lumbar	37	16.0	11.0	73.0
Total	67	25.4	6.0	68.6
Hips	19	31.6	0	68.4
Shoulders	3	33.3	0	66.7
Knees	13	30.8	23.0	46.2
Miscellaneous	3	0	0	100
Total	38	29.0	7.9	63.1
Total all osteoarthritis	105	26.6	6.7	66.7
			73.4	
Rheumatoid Arthritis				
Spine	6	16.7	33.3	50.0
Shoulders	1	100	0	0
Hips	1	100	0	0
Knees	2	0	0	100
Total	10	30.0	20.0	50.0
			70.0	
Bursitis	5	0	20.0	80.0
Periarticular disease	2	50.0	0	50.0
Osteoporosis	4	50.0	0	50.0
Total	11	27.4	9.0	63.6
			72.6	

* Total number of different areas in all patients.

on the larger machine, the two were used interchangeably as necessity ruled. Physical factors were as follows: for the 200-kv. unit, 0.5 mm. of copper and 1 mm. of Al filter (h.v.l. 1.05 mm. Cu), 50 cm. target-skin distance, 38 r/minute output; for the 400-kv. unit, inherent filtration equivalent to 1.75 mm. Cu (h.v.l. 2.4 mm. Cu), 50 cm. distance, 50 r/minute output. The spinal areas were treated through an 8 × 20 cm. port (1 to 3 areas), the smaller joints through 10 × 10 or 15 × 15 cm. ports. Spinal areas received 3 × 150 r (in air) on successive days or 3 × 200 r on alternate days. Caution must, of course, be used in treating the lower lumbar region and lumbosacral area in women under forty years of age, since there is a definite possibility of interference with the menstrual cycle. This should be explained to each patient belonging to that group so that she will not become disturbed if it does occur. In younger women we would not recommend the administration of roentgen therapy over these areas for arthritis. For the smaller joints the same dosage and intervals were used, or smaller doses applied to both anterior and posterior ports. Such therapy will be referred to hereafter as a series of treatments. We do not believe that higher single doses are necessary, although they have been advocated (5). Most patients received one series of treatments, but about 40 per cent had two series, and a small number three. Series were spaced four to six weeks apart. No patient in this study was treated more than three times, although we would give one or two more series after an interval of six months if indicated. With this amount of radiation no permanent harm is done to the skin.

RESULTS IN ARTHRITIS

A comparison of the three total figures underlined in Table I indicates that the response to treatment is in all probability due to a non-specific analgesic effect (2); these totals agree within a few per cent. The number of patients other than those suffering from osteoarthritis is too small for final interpretation, but the agreement

TABLE II: AGE DISTRIBUTION AND RESULTS OF ROENTGEN THERAPY IN OSTEOARTHRITIS

Age Group	Per Cent of Total	No Relief %	Slight Relief %	Moderate or Complete Relief %
40–50	16.9	23.1	15.4	61.5
50–60	25.9	10	5	85
60–70	39.0	36.7	...	63.3
70–80	14.3	36.4	9.1	54.5
80–	3.9	33.3	33.3	33.3

TABLE III: DEGREE OF INVOLVEMENT AND RESULTS OF ROENTGEN THERAPY IN OSTEOARTHRITIS

Degree of Bony Involvement	No Relief, %	Slight Relief, %	Moderate or Complete Relief, %
Severe	25.5	6.4	68.1
Moderate	10	5	85
Minimum	42.1	10.5	47.4

is striking both as to results in similar groups reported elsewhere (8) and in the hypertrophic group in this study. An additional group of 100 cases treated prior to 1945 and selected at random was analyzed and the results were almost identical.

With particular reference to the group of osteoarthritis of the spine (any or all subdivisions of the spine considered one area), approximately 75 per cent of the patients reported moderate to complete relief of pain. All reporting only slight relief had only one series of treatments.

The age of the patient and the severity of the disease are not reliable indications of results to be expected except that there is suggestive evidence that the percentage of good results obtained decreases with advancing age (Tables II and III). Of the 3 patients in the fifth decade of life receiving no benefit, 2 were women with minimal changes in the spine and the other was a male with only moderately advanced disease of one knee. In the fifty to sixty year group 85 per cent had moderate or complete relief of pain; yet 62 per cent of that category had severe changes on x-ray examination. We feel that this latter group represents people still engaged in active life who have both the vitality to "keep moving" and the desire to "get well." What role psychotherapy plays we do not know, since no controls were kept; placebo therapy was not tried. Smyth, Freyberg, and Peck (9) were able to use placebo therapy in cases of rheumatic disease and assign a definite and prominent role to psychotherapy. Our attitude is that if the patient has pain he deserves treatment; if the pain is relieved, the therapy may be considered successful. Nothing more is promised any patient than some relief of pain. The majority of our patients reported disturbance of sleeping habits due to pain, especially after the first and second exposures.

Harmful effects from the treatment are not to be expected, although an occasional one is seen. Sometimes there is an exacerbation of symptoms for a period of one to two weeks and all patients should be warned of this possibility; nausea may occur in those treated over the lumbosacral region. Favorable results, if effected, should not be accepted until three to four weeks following a series. No person should receive any form of local heat or massage to the part under treatment, since this may produce an erythema out of proportion to either the radiation or heat applied. One of our patients had temporary epilation of the hairline from therapy to the cervical spine.

This paper does not cover the question of the duration of relief of symptoms. However, the great majority of the results tabulated were gathered six months after therapy; we believe this period of time to be a fair estimate of the average duration of benefit to be expected in at least 70 per cent of these patients. Two illustrative case reports are given below.

CASE 1: F. G., a white male 59 years of age, had had pain in the left hip for the preceding two or three years, particularly marked when driving, when he first went to bed at night, and in the morning. Roentgenograms showed minimal osteoarthritis of the hip joint. In June 1945 the patient received 3 × 150 r (in air) to the left hip and experienced relief of pain for about one year. At that time there was some recurrence, and a second series was given in August 1946. Partial relief of pain followed, and a third series is planned.

CASE 2: H. L., a white female 69 years of age, had had increasing pain in the right hip and low

TABLE IV: RESULTS IN ROENTGEN THERAPY IN 69 CASES OF SUBDELTOID BURSITIS

	Complete Relief	Moderate Relief	Slight Relief	No Relief
First series	25 (36.2%)	32 (46.4%)	4 (5.8%)	8 (11.6%)
Second series	6*	1‡	.....	.....
Three or more series	2†	.....	.....	.....
	84%		16%	

* Only moderate relief after first series. † Only moderate relief after second series. ‡ Only slight relief after first series.

back for the preceding five or six years. It had become so severe that she was unable to do her housework or to walk outside the house. Roentgenograms showed a transitional vertebra with an articulating transverse process on the right at the lumbosacral junction and severe osteoarthritis of the lumbar spine with moderate changes in the sacroiliac joints and hip joints. Roentgen therapy was administered to the painful right sacroiliac and hip joint areas in January 1945; the dosage was 3 × 150 r (in air). When the patient returned six weeks later, she reported partial relief of pain and a second series was given. Pain was almost completely relieved and, although some stiffness remains, she has resumed doing her own work and is able to take short walks to see her neighbors.

RESULTS IN BURSITIS

The results of the treatment of bursitis are recorded in Table IV. The response to x-ray therapy was good; either complete or satisfactory relief occurred in 84 per cent of all cases. Although the absolute number of those receiving a second or third series was small, we gained the impression that the additional benefit obtained by further treatment was not striking. Over 50 per cent of all cases showed calcification on roentgen examination before treatment.

In many instances there is a differential diagnostic problem involved, especially in the shoulder region. This has been discussed in detail in the two preceding papers and we will merely state that often it is difficult to differentiate a true bursitis with calcification from what is called peritendinitis calcarea (6). It has been our practice to accept the diagnosis of the orthopedic consultant as based on his clinical and our roentgenographic examinations.

The acute bursitis with agonizing pain, if seen and treated within the first twenty-four hours after the onset, in our opinion stands the best chance for relief, but a good many of the chronic cases are relieved of pain, and in some a definite increase in the range of motion can be achieved. In these patients, properly supervised exercise should supplement roentgen therapy; for that reason, close co-operation between radiologist and orthopedic surgeon is indispensable.

The technic of treatment is that outlined above. In the acute cases one course of treatment usually suffices and quite frequently reduces the calcification completely or appreciably if this is present at the time treatment is started. Good relief of pain was seen in patients in whom the calcium deposit disappeared as well as in those in whom all of the original deposit remained or was only partially resorbed. Two illustrative case reports are appended.

CASE 1: A white male, age 40, woke up early in the morning of Sept. 25, 1943, with severe pain in the left shoulder. He was unable to move the arm sufficiently to put on his coat. Local application of heat did not bring relief. On the following night the pain became so excruciating that even large doses of morphine did not alleviate it appreciably. Roentgenograms of the shoulder showed a calcium deposit in the region of the subacromial bursa (Fig. 1, A). The clinical findings were typical of bursitis. X-ray therapy was started on Sept. 26: 3 × 150 r (in air) with a h.v.l. of 1.05 mm. in Cu were given to the anterior and posterior left shoulder on three successive days. Within twenty-four hours after the first treatment there was considerable relief of pain. Roentgenograms taken on Oct. 6 showed very little residual calcification and almost normal function of the arm had been restored (Fig. 1, B).

CASE 2. White female, age 66, while visiting in Florida, suffered from a bursitis in the right shoulder. Heat was applied for several days without material relief of pain. On March 29, 1946, a roentgenogram of the right shoulder showed a calcium deposit in the region of the subacromial bursa (Fig. 2, A). The patient was treated there by x-ray—"1/4 erythema unit"—and then returned to Madison. The pain

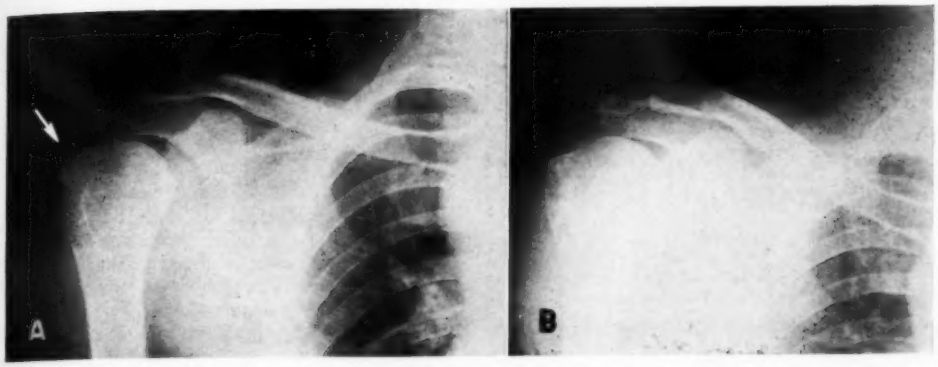

Fig. 1. Bursitis, Case 1. A. Roentgenogram taken on Sept. 27, 1943, showing calcium deposit (arrow). B. Roentgenogram taken on Oct. 6, eight days after the last treatment, showing little evidence of residual calcification.

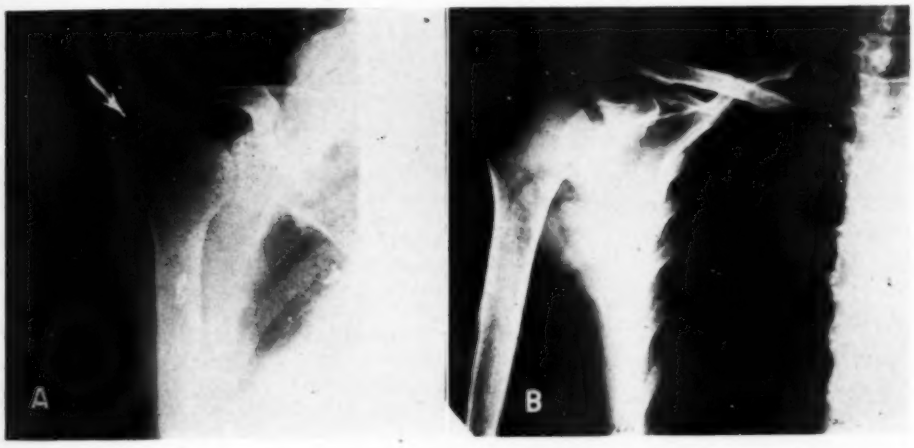

Fig. 2. Bursitis, Case 2. A. Roentgenogram taken on March 29, 1946, showing calcium deposit (arrow). B. Roentgenogram taken on May 20, one month after the last treatment, showing little evidence of residual calcification.

was temporarily relieved but recurred. She consulted us and received 2 × 150 r over the anterior and posterior right shoulder with a h.v.l. of 1.05 mm. in Cu on April 18 and 19, 1946. Within forty-eight hours after the last exposure she was comfortable. Roentgenograms taken on May 20, 1946, showed very little residual calcification (Fig. 2, B) and function of the arm was normal.

COMMENT

After a careful analysis of our clinical material, we have reached the conclusion that the prime value of roentgen therapy in chronic arthritis, bursitis, and allied conditions lies in the analgesic effect (3). The same holds true for acute bursitis, although here the action is of a curative nature, since the inflammatory process is itself favorably influenced, as is so well known from our experience in other acute inflammatory conditions. We feel that roentgen therapy has definitely something to offer to this group of patients; whether the effect is entirely due to the analgesic action of the rays or partially due to a psychological factor should not—in our opinion—prevent us from giving the method a fair trial. As to the mechanism of the effect of roentgen rays on osteoarthritis, we have no hypothesis or theory to offer.

In closing, we would like to emphasize that the views presented in this paper are

largely based on our observations in osteoarthritis and bursitis. While we have seen satisfactory response in some patients with rheumatoid arthritis, osteoporosis, and spondylitis rhizomélique, the number of cases treated is not large enough for statistical analysis.

SUMMARY

1. The experience in the treatment of arthritis and bursitis by roentgen rays in the Department of Radiology, State of Wisconsin General Hospital, has been related.

2. The technic of treatment is described in detail.

3. An analysis of 100 consecutive cases of osteoarthritis reveals that satisfactory relief from pain may be expected in approximately 75 per cent; the corresponding figure for 69 cases of bursitis was 84 per cent.

4. No theory as to the mechanism of the therapeutic effect is offered; we have the impression that it is based on a nonspecific analgesic action of the roentgen rays.

Department of Radiology
University of Wisconsin Medical School
Madison 6, Wis.

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DISCUSSION OF SYMPOSIUM ON ROENTGEN DIAGNOSIS AND THERAPY OF BURSITIS AND ARTHRITIS

(Papers by D. Murray Angevine, Lester W. Paul and Wm. W. Moir, and Ernst A. Pohle and James A. Morton)

S. Archibald Morton, M.D. (Milwaukee, Wis.): These papers, I feel, offer many interesting points. Dr. Paul has covered the subject of diagnosis well. There are many things about calcareous tendinitis that are hard to understand. Why is it—perhaps Dr. Paul or Dr Angevine can give us the answer—that we see calcified tendinitis about the shoulder joints so frequently and about the other joints so infrequently? The shoulder is not a weight-bearing joint; it is not a joint that is particularly subject to trauma. We do not see calcified tendinitis in the knee joint, for though calcifications are seen about the joint, we do not see them particularly in the tendons.

I believe that it is impossible to examine a shoulder joint adequately with a single film, and I believe all of us should work out some sort of a routine of examination so that all the areas of tendinous insertion will be demonstrated. There may be an area of calcification in a subscapularis tendon which is impossible to demonstrate in anteroposterior films alone. I would like to commend for your use a procedure published by Dr. Charles Blackett and Dr. Thomas Healy in the *American Journal of Roentgenology* (**37:** 760, 1937).

In my experience I am not able to say very much about the etiological agent on merely looking at a case of arthritis—*i.e.* whether it is a tuberculous arthritis, septic, gonorrheal, or what not. I believe that the radiologist can say that a destructive arthritis exists, probably tuberculous or probably septic, and that it should be the province of the pathologist to identify specifically the offending agent. All of us have treated these cases of arthritis and bursitis with good results.

I think it is exceedingly difficult to evaluate the effect of treatment in cases with degenerative changes about joints, which we see so frequently. Some patients have pain, some have no pain, and the extent of the involvement does not parallel the amount of pain.

In some of these conditions the trouble is obviously due to mechanical difficulties, and it is hard to see just how much roentgen therapy is going to do to the mechanical factors involved. In many of these patients roentgen therapy does not produce very beneficial results. I have had much better results in the treatment of spondylitis rhizomélique and Marie-Strümpell arthritis than I have in treatment of ordinary degenerative changes about the spine.

The treatment of calcareous tendinitis offers interesting problems, too. Do we know whether calcium is the *cause* of the condition, or its *effect?*

I would like to ask Dr. Pohle if he has had any difference in his results in cases in which calcification was present and those with no calcification. I would like to ask also what his experience has been in those cases that Dr. Paul referred to as the "frozen shoulder." In my experience x-ray therapy has done little for such patients; physical therapy has done liftle for them, and I am not so sure that the great healer "Time" is not better than any of our efforts. In addition to trouble in the shoulder, these patients also have vasomotor tension in the hands, with pain and swelling.

L. M. Hilt, M.D. (Eugene, Ore.): During the war we treated quite a few shoulder cases because we did not have time for surgery, and we obtained some remarkable results. They say you know a disease very well if you have it yourself. One day I felt pain in my fingers and right shoulder. I took a film and found I had two small calcifications and one rather large one. As I am left-handed, the question of using the involved shoulder more than the other did not enter into the matter. Within a year's time one series of treatments was sufficient. I have had no symptoms now for about two years. I have treated physicians and others, and, while I have kept no statistics, the results have been most satisfactory.

Vincent W. Archer, M.D. (University, Va.): I am not a therapist but I have heard a great deal this week about the danger of repeated small doses of radiation. In a chronic recurring disease like osteoarthritis, what is going to happen if treatment is followed by relief for six months? Then are you going to repeat the treatment for four months? Wouldn't it be well to use everything else first and resort to irradiation only when other measures fail?

D. M. Angevine, M.D. (*closing*): Concerning calcification in the tendons, I do not believe we know the exact mechanism. When one examines a large number of joint capsules from "frozen" joints, however, it is amazing how much calcification there is in such tissues, probably far more than is realized from x-ray examination. I believe that calcification here is probably very much the same as elsewhere in the body. It usually occurs under two conditions: (1) hemorrhage and (2) degeneration of tissue. I believe, therefore, that there must be some degeneration in the joint capsule.

Ernst A. Pohle, M.D. (*closing*): As to the question of Dr. Morton, we did not pay any attention to the relationship between calcification present at the time of the treatment and the response, but we did find, as we stated in the paper, that relief from pain was obtained whether or not the calcification disappeared or remained. However, this is an interesting problem and I think from now on we will study it and may be able to give you a report later.

As to the "frozen shoulder," we have had just as little luck as others.

One important point has been raised. Numerous small doses of radiation, if repeated, too often lead, of course, to a late reaction, with the certainty of a planned experiment. As we stated in the paper, we give up to three series from four to six weeks apart. If after six months the symptoms recur, we may give one or two more series and then no more. In our five years of experience, up to now, no late reactions have occurred with this amount of treatment. However, the tolerance varies with the individual and therefore the final decision as to the safe total dose rests with the radiologist.

SUMARIO

Roentgenoterapia de la Artritis, Bursitis, y Estados Afines

Preséntanse las observaciones realizadas en el tratamiento de la artritis y la bursitis con los rayos X en el Departamento de Radiología del Hospital General del Estado de Wisconsin.

El tratamiento fué a base de 200 kv. (equivalente potencial constante de 175) (filtración por 0.5 mm. de cobre y 1 mm. de aluminio, capa de hemi-reducción de 1.05 mm. de cobre, 50 cm. de distancia foco-piel, 38 r por minuto), o de 400 kv. (filtración inherente equivalente a 1.75 mm. de cobre, capa de hemi-reducción de 2.4 mm. de cobre, 50 cm. de distancia, 50 r por minuto). Las zonas raquídeas recibieron 3 × 150 r (en el aire) en días sucesivos o 3 × 200 r cada dos días, y las articulaciones más pequeñas una dosis semejante por vía anterior y posterior. En algunos casos repitióse el tratamiento al cabo de cuatro a seis semanas, y en muy pocos se administró una tercera serie.

El análisis de 100 casos consecutivos de osteoartritis revela que cabe esperar alivio satisfactorio del dolor aproximadamente en 75 por ciento; la cifra correspondiente en 69 casos de bursitis fué de 84 por ciento.

No se ofrece ninguna teoría en cuanto al mecanismo del efecto terapéutico, pero existe la impresión de que se basa en una acción analgésica anespecífica de los rayos X.

Roentgen Diagnosis of Pigmented Villonodular Synovitis and Synovial Sarcoma of the Knee Joint

Preliminary Report[1]

RAYMOND W. LEWIS, M.D.

Director, Department of Radiology, Hospital for Special Surgery, New York, N. Y.

IN 1941 Jaffe, Lichtenstein, and Sutro (1) wrote of the pathology of certain diseases of joints, tendon sheaths, and bursae. They showed the histologic linkage and essential unity of lesions previously described in the literature under a wide variety of designations, *i.e.*, such synovial and bursal lesions as chronic hemorrhagic villous synovitis, giant-cell fibro-hemangioma, fibro-hemosideric sarcoma, sarcoma fusigigantocellulare, benign polymorphocellular tumor of the synovial membrane; and such tenosynovial lesions as xanthoma, xanthogranuloma, giant-cell tumor, and myeloplaxoma. All of these pathological conditions they grouped together under the name of pigmented villonodular synovitis. These same authors wrote that in joints, pigmented villonodular synovitis may occur in circumscribed or diffuse form. In the circumscribed form, the affected synovial membrane shows one or more yellow-brown sessile or stalked tumor-like nodular outgrowths. In the diffuse form (Figs. 1 and 2) the membrane appears brownishly pigmented and covered by villous and coarse nodular outgrowths. The authors were of the opinion that the condition should not be considered neoplastic, but rather inflammatory in nature, though they had no suggestion to offer with regard to the agent provoking the inflammatory response.

Both pigmented villonodular synovitis and tumors of the knee joint may occur as circumscribed or single lesions (1, 2, 3), and in some instances may be demonstrated roentgenographically (Fig. 3). We have thus far been unable from the x-ray appearance alone to do more than hazard a guess as to the character of these solitary lesions. Our principal concern in this communication is with the diffuse synovial lesions, and to these we shall confine our attention.

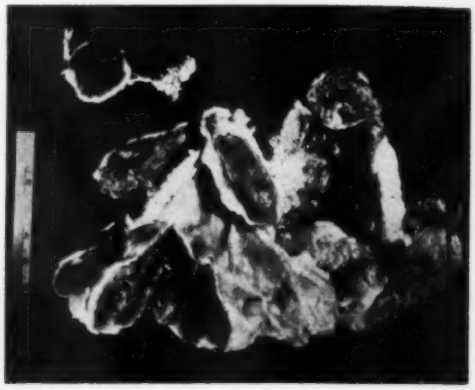

Fig. 1. Case 1: Synovial membrane in pigmented villonodular synovitis, showing thickening, pigmentation, nodular surface, xanthomatous pedunculated tumor.

Although the radiographic characteristics of diffuse villonodular synovitis and diffuse intracapsular tumors of the knee joint, of which synovial sarcoma (synovioma) is the most common, are often identical, the general characteristics of this group are as a rule so typical that, after seeing a few cases, the radiologist is able almost at a glance to classify a new one as belonging in this broad category. These characteristics are as follows (Figs. 4–7): bones of a young adult; monarticular involvement; excessive amount of synovitis, which may appear smooth in outline and homogeneous in density, but is particularly diagnostic when it is, in part at least, nodular in outline and den-

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

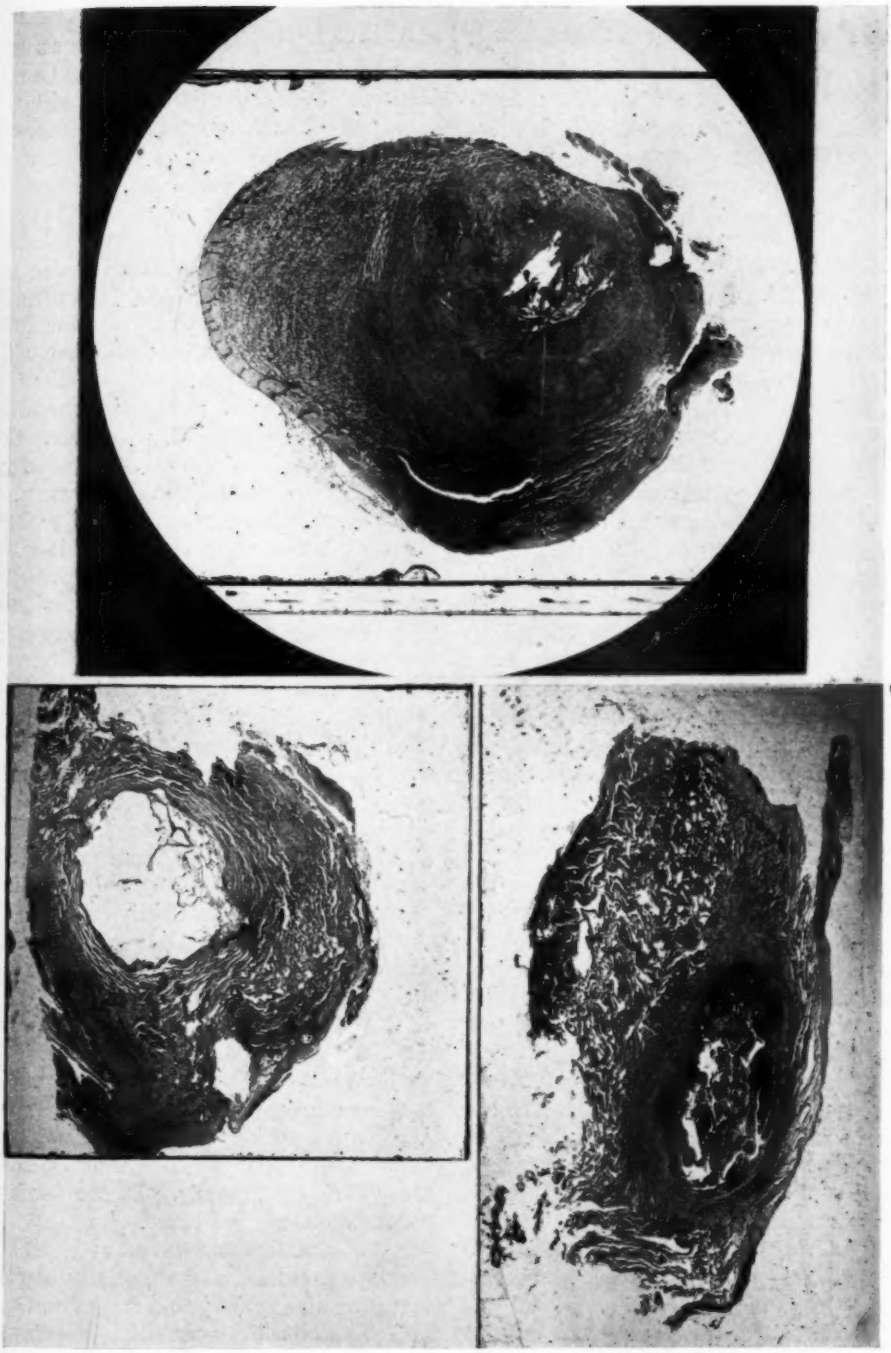

Fig. 2. Case 1: Low-power histological sections, showing thickening, traumatic hemorrhage becoming organized, xanthomatous tumor. Figures 1 and 2 shown through the courtesy of Doctor Milton Helpern.

sity, as is frequently the case; joint spacing symmetrical and normal, giving no indication of cartilage abnormality; completely normal appearing bones, without even osteoporosis; no evidence of thigh or leg atrophy: in summary, excessive synovitis, often nodular in outline and density, in a young person, with everything else completely normal.

Typical history and clinical findings are as follows: young adult; rather long history of knee swelling, usually one to several years; no known etiology, though occasionally the onset of the swelling is blamed on some minor injury; relatively little discomfort or disability (the limitation in motion is usually entirely mechanical and due to the synovitis; the rather minor disability explains the absence of osteoporosis); no fever, and normal or somewhat increased sedimentation rate.

The differential diagnosis in this group of cases, comprising diffuse villonodular synovitis and diffuse synovial sarcoma, is as follows: the lobulated and nodular character of the joint swelling is seldom found in other conditions and is therefore a most important differential point. In addition to this, the following are helpful: the degree of joint distention is in excess of that usually encountered in traumatic cases without fracture, and the immediate examination excludes the hemorrhage of fracture by excluding fracture. An equal degree of distention occurs in hemophilia, but in that disease there are usually old degenerative changes in cartilage and bone. Against rheumatoid arthritis are the monarticular character of the lesion, the absence of osteoporosis, which is likely to occur rather early in that disease, and the absence of the symptoms and signs found in rheumatoid arthritis. Against acute infectious arthritis are the presence of more synovitis than one would expect in the early days of that disease, and the absence of acute demineralization of the bone about the joint, which occurs after the first few days. Also the histories of the two conditions are radically different. Against rather early tuberculosis are the absence of osteoporosis and of thigh or leg atrophy, and the complete absence of pain and disability. Osteoarthritis is excluded by the youthful joint, the absence of degenerative changes in bones and cartilages, and the excessive degree of synovitis.

As mentioned earlier, diffuse villonodular synovitis and synovial sarcoma of the knee joint are frequently indistinguishable from each other radiographically (compare Fig. 8 with Figs. 4, 5, 6, and 7). Nor do the histories and physical examinations aid in the differential diagnosis, for they are practically identical in the two conditions. We have encountered, however, three distinguishing radiographic features, and when any one of the three is present, the disease may be recognized as probably synovial sarcoma and not villonodular synovitis. *First*, if the nodular soft-tissue masses are in part or wholly outside the joint capsule (Fig. 9), the lesion is not villonodular synovitis, but may be synovial sarcoma, fibrosarcoma, or some other condition. *Second*, if the lobulated soft-tissue masses in or near the joint contain scattered and irregular deposits of amorphous lime (Fig. 10), the lesion is almost certainly a synovial sarcoma (4). *Third* if the lesion of the soft tissues of the joint has invaded bone (Fig. 11), the condition is probably synovial sarcoma.

This report has been labeled preliminary because of the few proved cases. There are 4 cases proved by operation, with 7 additional cases which are characteristic clinically and roentgenographically but which have not been operated upon. The lack of success attending synovectomy in our early cases was so striking that the later cases were for the most part not subjected to surgery. Hence our low incidence of proved cases. In view, however, of the importance of establishing a precise diagnosis, and especially of differentiating the synovioma cases from those of villonodular synovitis, exploratory operation and biopsy would seem definitely indicated, and it is possible that this may become the accepted practice of the future.

Although therapy is not rightly included

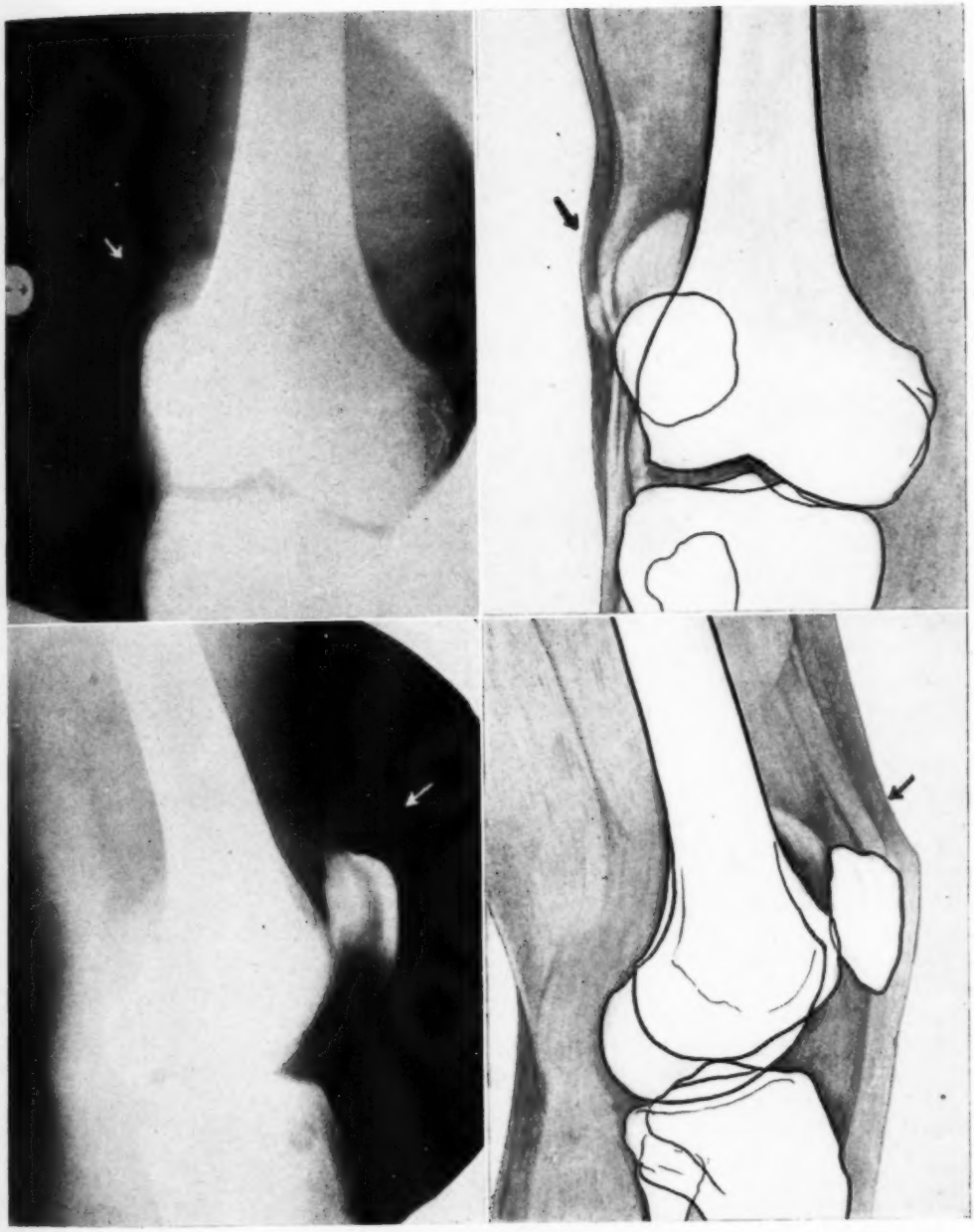

Fig. 3. Single tumor, hemangioma, in knee joint. This might equally well be circumscribed villonodular synovitis. Precise roentgenological diagnosis in single tumors is usually not possible. Reproduced by permission of Am. J. Roentgenol. (5).

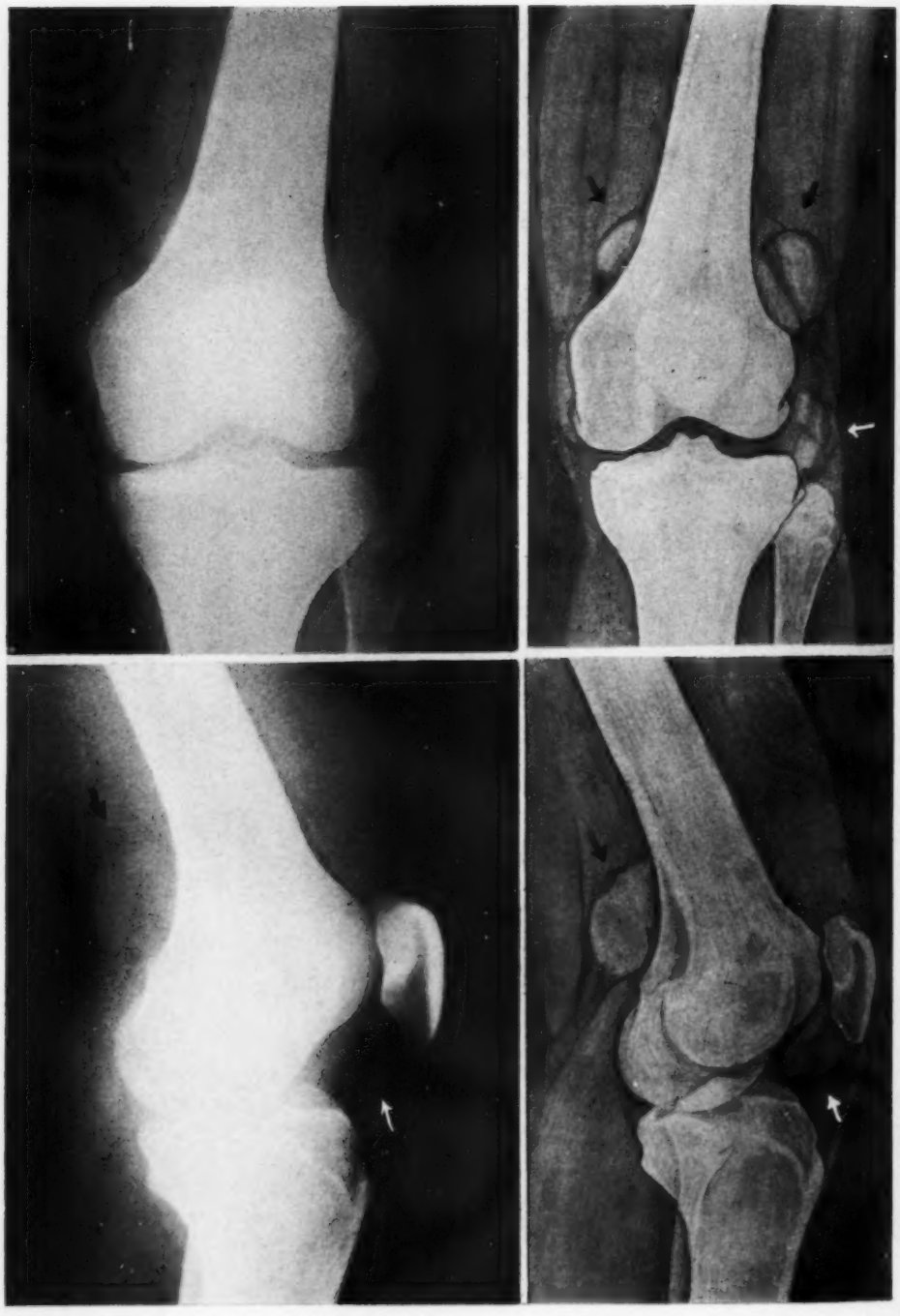

Fig. 4. Case 1: Pigmented villonodular synovitis of characteristic appearance: extreme synovitis, with nodular pattern; joint spacing normal and symmetrical, giving no indication of cartilage abnormality; completely normal appearing bones, without even osteoporosis.

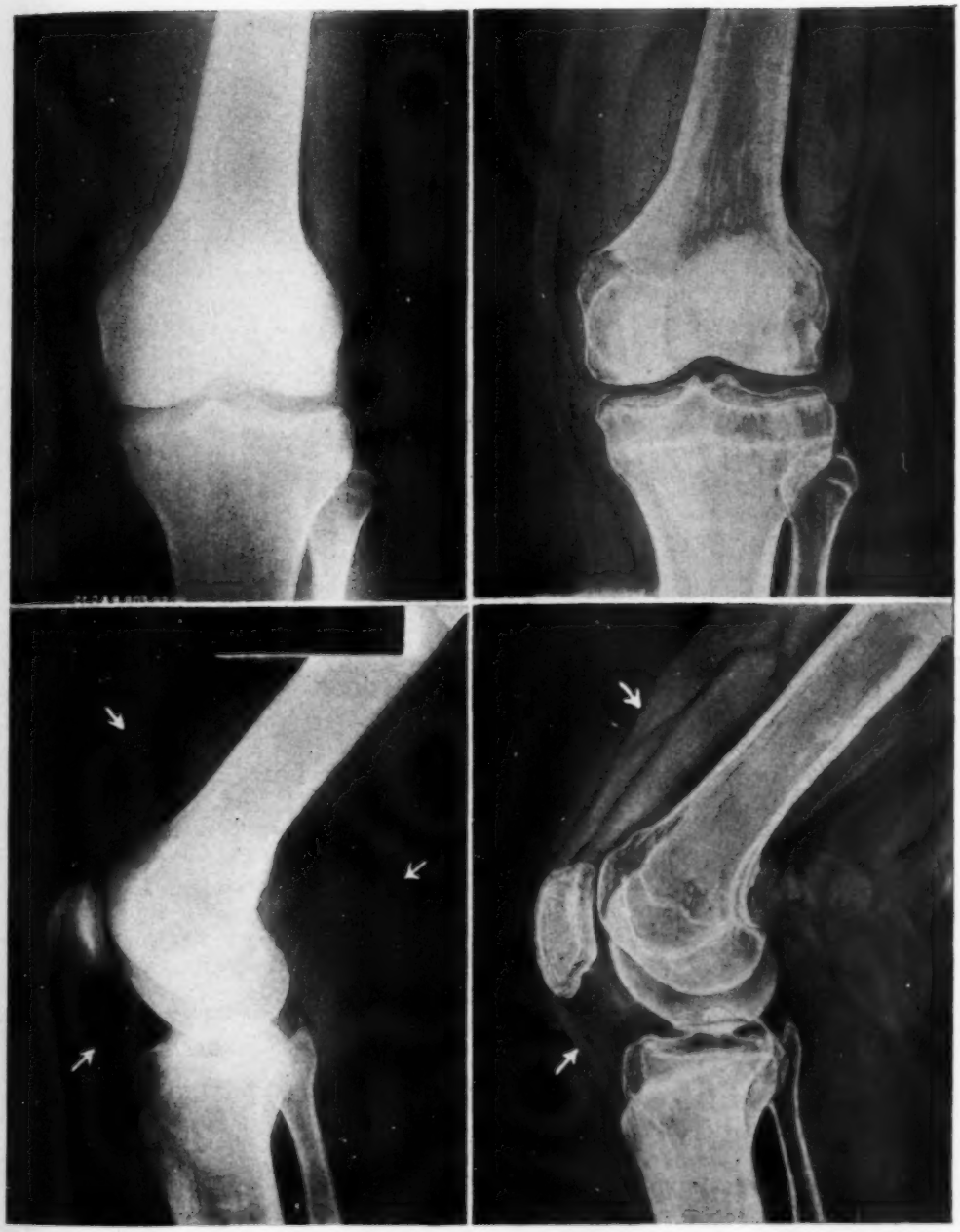

Fig. 5. Case 2: Pigmented villonodular synovitis. Findings similar to those in Case 1, shown in Figure 4. The nodular pattern is especially evident in the posterior portion of the joint.

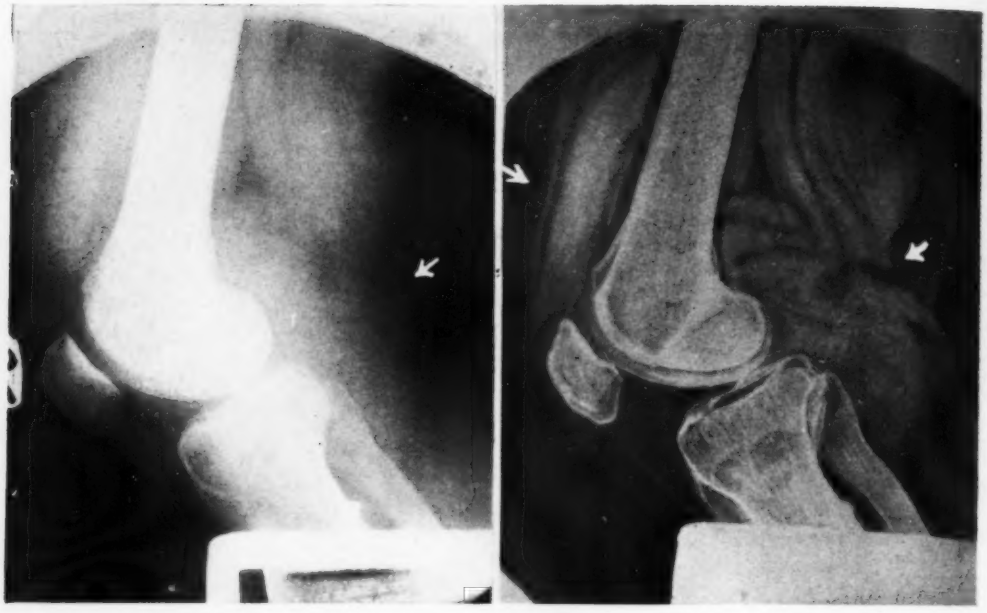

Fig. 6. Case 3: Pigmented villonodular synovitis. Findings similar to those in Case 2, Figure 5, with the nodular pattern particularly noticeable posteriorly. Shown through the courtesy of Lt. Col. E. C. Holscher, Chief of Orthopedic Section, Lawson General Hospital.

in this presentation, a few brief remarks on treatment seem in order. Surgery seems to have failed completely in relieving villonodular synovitis. Our first patient had a recurrence after two attempts at complete synovectomy. In our second patient, a second operation was necessary to remove large calcareous and osseous bodies which formed in the suprapatellar pouch following the first operation. This patient was then lost track of before we learned the final outcome. In the third proved case, shown through the courtesy of Lt. Col. E. C. Holscher, Chief of the Orthopedic Section, Lawson General Hospital, there had been no evidence of recurrence during a short follow-up period. The outcome, however, seems dubious, since the preoperative roentgenograms showed much involvement of the posterior portion of the joint, and it is known that this region was not cleaned out adequately at operation. In another case of Colonel Holscher, not included in this series because the preoperative films were not available, there was recurrence following surgery. In our fourth and very recent case, the result is not yet known. That is, in 5 cases treated by operation, results are known to be unsatisfactory in 3, the outlook is dubious in the fourth, and the result is as yet unknown in the fifth.

Jaffe and Lichtenstein (6) report good results in villonodular synovitis following roentgen-ray therapy, and Friedman and Ginzler (7) describe radiation treatment of one case with an excellent outcome. We at our hospital are trying this medium, but have as yet no results to report.

CASE REPORTS

CASE 1. E. Van V., female, age 20, came to the clinic Nov. 24, 1942, with swelling of the left knee, present for a year and a half. The onset occurred after bumping the knee on a chair under the table. The patient had been seen by several doctors without improvement.

Examination showed much swelling of the knee, but free motion, lacking only 30 degrees of complete flexion. The blood count was normal; sedimentation rate 11 mm. in one hour. The Kline reaction was negative. Culture of fluid aspirated from the

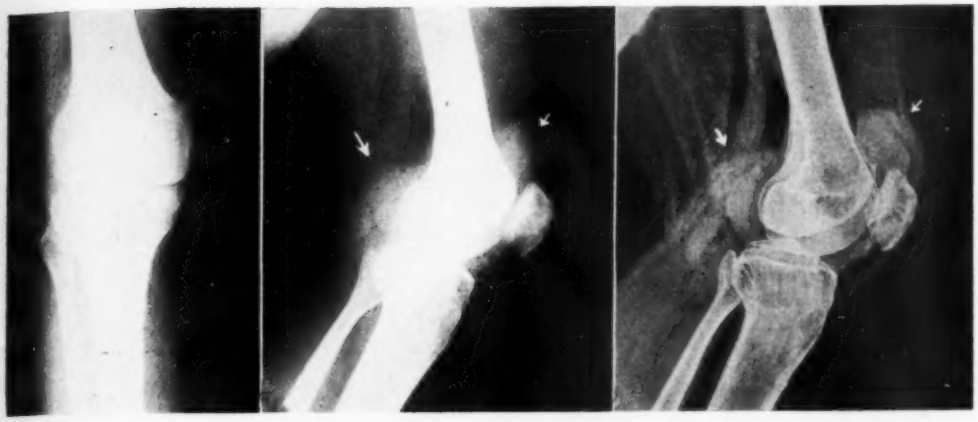

Fig. 7. Case 4: Pigmented villonodular synovitis. Extreme generalized synovitis, but in this instance the pattern is not definitely nodular. There is no suggestion of bone or cartilage abnormality.

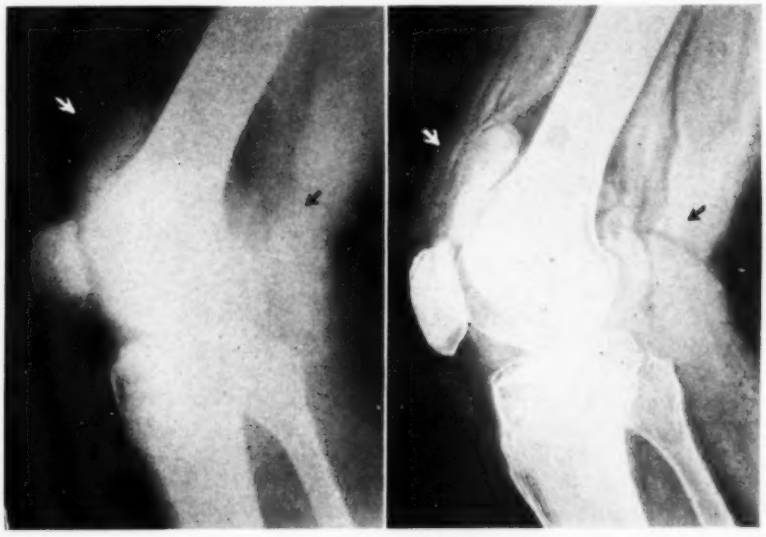

Fig. 8. Synovioma, synovial sarcoma, in this instance not distinguishable radiographically from the pigmented villonodular synovitis cases shown in Figures 4–7. Reproduced by permission of Dr. D. A. De Santo and Surg., Gynec. and Obst. (3).

knee joint showed no growth, and guinea-pig inoculation gave no evidence of tuberculosis.

The findings on x-ray examination are shown in Figure 4.

Conservative treatment in plaster brought no improvement, and synovectomy was done on Feb. 5, 1943. The pathologist's report was chronic proliferative and hemorrhagic villous synovitis with hemosiderosis and xanthomatous formation.

Synovectomy was again done on May 19, 1944. The report of the pathologist was chronic proliferative pigmented villonodular synovitis.

Examination on Oct. 15, 1945, showed clinical and roentgenographic evidence of recurrence. There was some pain in the knee. Range of motion was limited to 30 degrees of flexion from full extension. The patient left this hospital, but it has been learned that she is receiving x-ray therapy elsewhere.

CASE 2. F. C., female, age 29, came to the clinic April 2, 1943, with swelling of the left knee of two years' duration. There had been no injury or other known etiology. Examination showed a distended joint, with a soft-tissue mass in the popliteal space. There was fairly good range of motion, with flexion restricted beyond 130 degrees. The blood count was normal; sedimentation rate 51 mm. in one hour. A

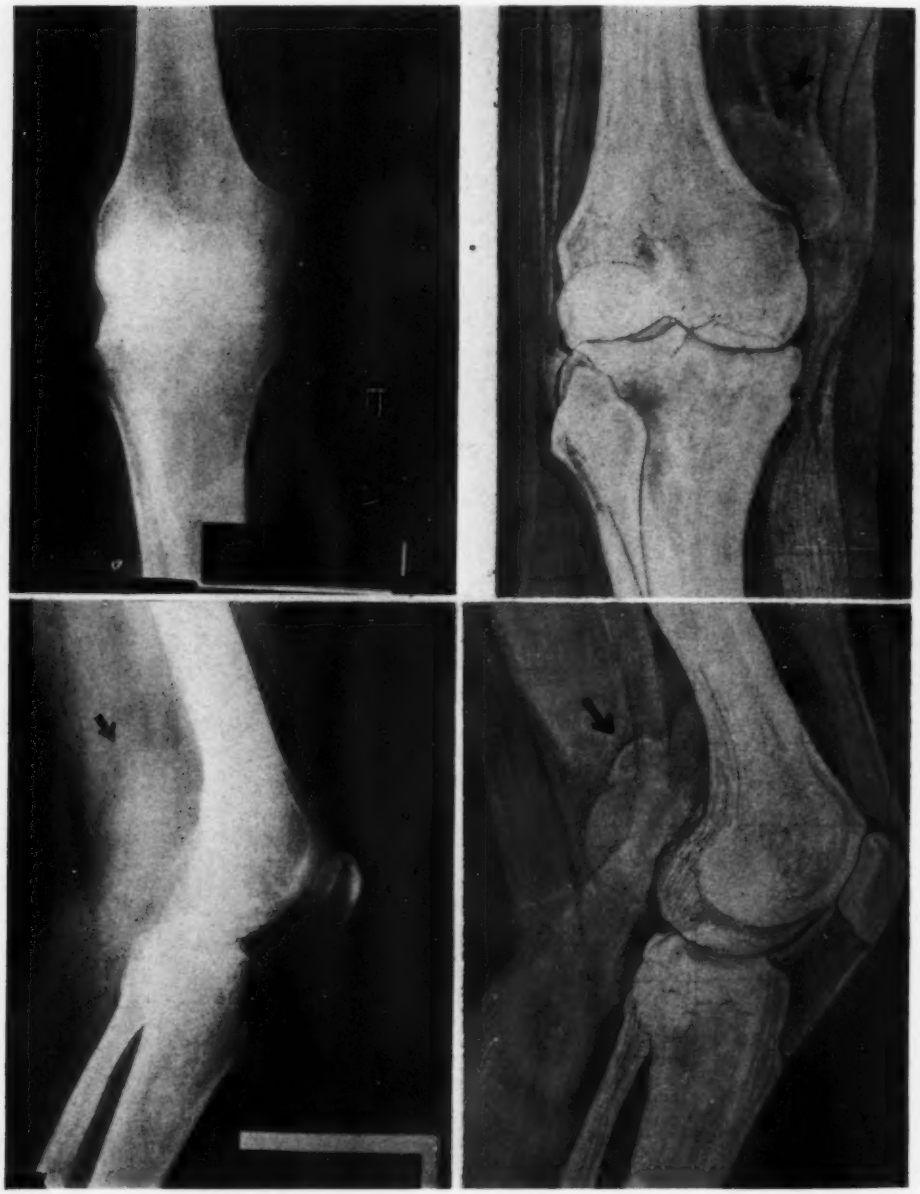

Fig. 9. Synovioma, synovial sarcoma. This case can be differentiated radiographically from pigmented villonodular synovitis because there is no generalized synovitis, since the suprapatellar and infrapatellar portions of the joint are found entirely clear. Therefore, the nodular soft-tissue mass in the popliteal space is probably extracapsular, and the roentgen diagnosis is tumor of some sort.

smear of fluid aspirated from the knee joint revealed no organisms. Culture of the fluid yielded no growth, and guinea-pig inoculation produced no evidence of tuberculosis.

X-ray examination was as shown in Figure 5.

Conservative treatment in plaster brought no improvement, and on July 2, 1943, synovectomy was performed. The pathological report was chronic pigmented proliferative villonodular synovitis.

A second operation was performed Nov. 12, 1943,

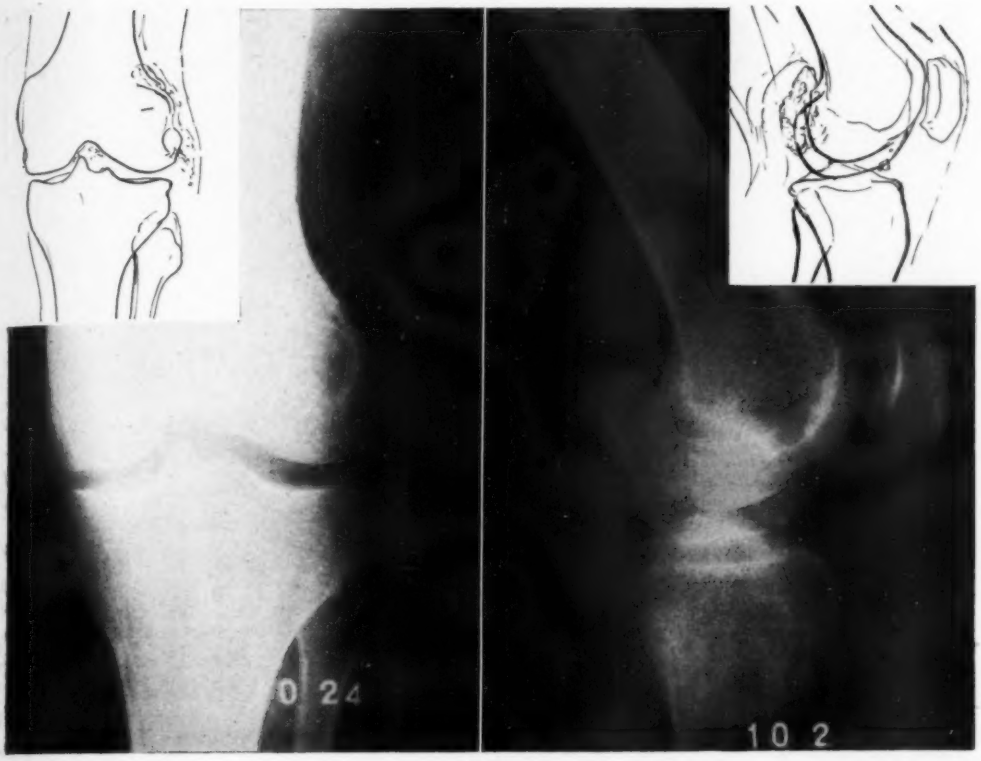

Fig. 10. Synovioma, synovial sarcoma. This case can be differentiated from pigmented villonodular synovitis because of the scattered and irregular deposits of amorphous lime in the lobulated soft-tissue masses. Radiographically this can be identified with a reasonable degree of certainty as synovial sarcoma. Reproduced by permission of Am. J. Roentgenol. (4).

for removal of calcifications and ossifications from the quadriceps pouch. The report of the pathologist was proliferated osseous bodies following synovectomy for villonodular synovitis.

The patient was last seen at the hospital Jan. 26, 1944, two and a half months after the second operation, at which time there was no evidence of recurrence, and motion was from full extension to 45 degrees flexion. She did not return again, or respond to requests that she attend the follow-up clinic.

CASE 3 (reported through the courtesy of Lt. Col. E. C. Holscher): F. L. P., male, technical sergeant, age 38, gave a history of chronic recurrent synovitis for several years, monarticular, right knee. There was no history of injury.

X-ray examination was as shown in Figure 6.

At operation the condition appeared like an old chronic hemorrhagic synovitis. No gross xanthomatous lesions were found. The report from the Army Institute of Pathology was pigmented villous synovitis.

During the short period the patient was followed after operation there was no evidence of recurrence, but it is known that the abnormal tissue at the back of the joint was not completely removed.

CASE 4: A. W., female, age 44, came to the clinic March 28, 1946, complaining of pain and swelling of the right knee, of one year's duration. There was no known cause. Examination showed no limp. There was swelling, but no tenderness and no pain on manipulation. A normal range of motion was present.

X-ray examination, April 1, 1946, showed a rounded density in the suprapatellar pouch of the joint, concerning which the suggestion was made that it might be exudate or a tumor mass. There was evidence of some generalized synovitis; there was no indication of cartilage abnormality.

On April 25, 1946, the sedimentation rate was 37 mm. in one hour.

X-ray examination Sept. 4, 1946 (Figure 7) gave findings much like those in the examination five months before. The appearance was believed consistent with pigmented villonodular synovitis.

At operation—Sept. 6, 1946—the synovium was found to be very thick and much inflamed. Villous nodules were present in the intercondylar space.

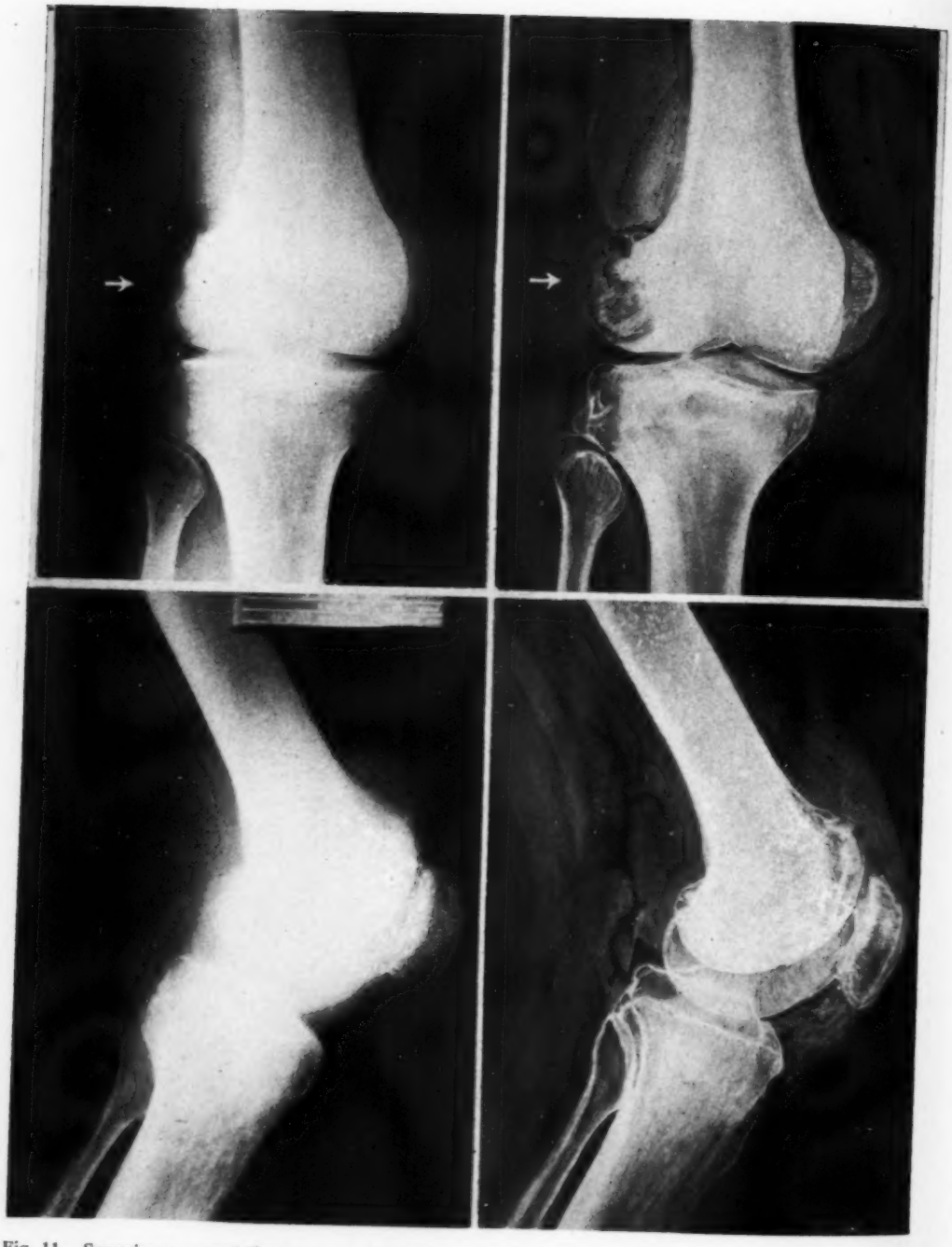

Fig. 11. Synovioma, synovial sarcoma, recognizable as not pigmented villonodular synovitis because the soft-tissue lesion of the joint has invaded bone. The probable x-ray diagnosis is therefore synovial sarcoma.

Radical synovectomy was performed. The report of the pathologist was pigmented villonodular synovitis.

The postoperative course was uncomplicated. Radiation therapy was started, and the patient was discharged Oct. 1, 1946.

SUMMARY

1. The pathology of pigmented villonodular synovitis as described by Jaffe, Lichtenstein, and Sutro has been briefly reviewed, and illustrations have been shown.

2. Circumscribed pigmented villonodular synovitis and single tumors of the knee joint are often demonstrable by x-ray, but can seldom be diagnosed precisely.

3. The distinctive characteristics of diffuse pigmented villonodular synovitis and synovial sarcoma of the knee joint, which are frequently indistinguishable from each other, have been described and illustrated.

4. Typical histories and physical findings of this group, and features for its differential diagnosis from other conditions, have been given.

5. Three distinguishing radiographic features by which synovial sarcoma may sometimes be differentiated from diffuse villonodular synovitis have been mentioned and illustrated.

6. We have few proved cases of villonodular synovitis because surgical treatment proved completely unsatisfactory in our early cases, and the later clinically and radiographically diagnosed cases were not subjected to surgery. In view of the importance of establishing precise diagnoses, and especially of differentiating synovial sarcoma from villonodular synovitis, exploratory operation and biopsy seem indicated.

7. There is some evidence that roentgen-ray therapy influences pigmented villonodular synovitis favorably.

NOTE: The author wishes to express his gratitude to Mrs. Olive Fischer for the excellent drawings and illustrations in this article and in previous publications.

321 East 42nd St.
New York 17, N. Y.

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DISCUSSION

Jacob Gershon-Cohen, M.D. (Philadelphia, Penna.): We have been privileged to listen to an excellent presentation, one which is of very material help in an analysis and appreciation of soft-tissue masses and tumors around the joints, particularly the knee joint. This contribution by Dr. Lewis on pigmented villonodular synovitis is significant because (1) it has given serious recognition to the important pathological investigations by Jaffe and his group; (2) it has shown a skillful roentgenological approach to these newer pathologic concepts; (3) it has demonstrated again the importance of roentgenographic soft-tissue shadows, and (4), it has shown Dr. Lewis to be a keen clinical observer, since this report drives an important wedge into the problem of understanding more precisely soft-tissue diseases of the joints, particularly of the knee.

The use of the word "synovioma" to designate a particular type of tumor of the synovial membrane, or to imply a sarcoma or even a broader group of other synovial membrane tumors, probably has no place in such a precise report as this, but the very use of this word demonstrates that we still have a stretch of blind road ahead of us before we come to the labeled avenues of synovial physiology and pathology.

The occurrence of pigmented villonodular synovitis in the young raises a suspicion of a mechanism at play similar to that which results in osteochondritis, and there is no reason why some radiologist rather than a sequestered laboratory worker should not some day discover that a transient hypovitaminosis or an avitaminosis during adolescence leads to this roentgenologic entity.

There is also room for more observation of this condition during adult and late life. Does the synovial change of this entity during adolescence lead to chondromatous synovitis or osteochondromatosis during adult life? This may not be a far-

fetched possibility when one remembers that the synovial membrane contains cells capable of metaplasia into cartilage or osteoblastic cells.

The suggestion made by Dr. Lewis of the good effects obtained with roentgen therapy should be vigorously pursued, especially since synovectomy has not proved too promising in the treatment of this condition.

SUMARIO

Diagnóstico Roentgenológico de la Sinovitis Pilonodular Pigmentada y del Sarcoma Sinovial de la Articulación de la Rodilla. Informe Preliminar

La sinovitis pilonodular pigmentada comprende varios estados patológicos descritos con distintos nombres, pudiendo presentarse en forma circunscrita o difusa en las articulaciones. Sobre la última forma es que versa este trabajo.

El cuadro radiográfico de la sinovitis pilonodular pigmentada difusa y del sarcoma sinovial de la articulación de la rodilla, que son frecuentemente indistinguibles, es típico, consistiendo en hipersinovitis, a menudo de contorno y densidad nodulares, en una persona joven, en la cual todos los demás datos son completamente normales. Las principales características clínicas comprenden: edema de la rodilla, relativamente leves malestar e incapacidad, apirexia y eritrosedimentación normal o poco aumentada.

Al señalar las características que diferencian este grupo clínico de otros estados, menciónanse e ilústranse tres rasgos radiográficos que permiten a veces distinguir el sarcoma sinovial, de la sinovitis pilonodular difusa, y son los siguientes: Primero, si los tejidos blandos nodulares quedan total o parcialmente fuera de la cápsula articular, no se trata de sinovitis pilonodular, pudiendo la lesión ser sarcoma, fibrosarcoma o algún otro estado sinovial. Segundo, si las masas de tejido blando lobulado en la articulación o cerca de ésta contienen depósitos irregulares y esparcidos de cal amorfa, trátase casi seguramente de sarcoma sinovial. Tercero, si la lesión del tejido blando de la articulación se ha extendido al hueso, el estado es probablemente sarcoma sinovial.

El autor cuenta con pocos casos comprobados de sinovitis pilonodular, porque el tratamiento quirúrgico resultó ser un completo fracaso en los primeros casos, y no fué utilizado en los últimos casos diagnosticados clínica y radiográficamente. Vista la importancia de establecer el diagnóstico preciso, y en particular de diferenciar el sarcoma sinovial de la sinovitis pilonodular, parecen hallarse indicadas la exploración operatoria y la biopsia.

Hay algunos indicios de que la roentgenoterapia afecta favorablemente la sinovitis pilonodular pigmentada.

Appendiceal Coproliths: Their Surgical Importance[1]

SYDNEY F. THOMAS, M.D.

Palo Alto, Calif.

THE CLINICAL diagnosis of appendicitis is still a major medical problem, not only because of its frequency but because of the morbidity which is associated with the condition, not to mention a mortality of over 17,000 deaths per year in the United States. The literature has been saturated with data on the cause, diagnosis, and treatment of the disease; in 1931 McClure (1) reported that over 9,000 articles had been written on appendicitis, and to that number over 3,000 have since been added, making a total of 12,000 articles. Even though great strides have been made in the technic of appendectomy, and despite the use of the more recent antibiotics (sulfa drugs and penicillin), the morbidity is still considerable and complications remain a serious hazard. In one large clinic (2) the complication rate is unchanged over a period of 19 years. The common origin of the complications in some mechanical factor must therefore be considered.

Roux (3) in 1913 was the first to write on the use of roentgen rays in the diagnosis of appendicitis. The early radiologic diagnosis of uncomplicated appendicitis is difficult and seldom essayed. However, when perforation has occurred with periappendiceal abscess formation, free peritoneal gas, peritonitis, subphrenic or subhepatic abscess, or even fistula formation, roentgen studies can give *prima facie* evidence not only localizing the disease but often exhibiting its extent. The early clinical diagnosis is recognized as all-important in appendicitis, but often the clinical signs are few and the history unconvincing, or possibly all signs and symptoms may be subsiding when the patient is first seen. It is in this group of cases—or at least a percentage of them—that the radiologist might be useful, especially where the appendix is found to contain a coprolith with enough calcium to cast a shadow on the roentgenogram.[2]

Because of the morbidity in 4 of the cases in our small series, it was thought wise to emphasize the importance of a roentgenographic diagnosis of appendiceal coprolith. The significance of this diagnosis is obvious when one reviews the literature on appendicitis and finds that the most frequently mentioned cause is appendiceal obstruction.

There are two types of appendiceal obstruction: (*a*) that due to external causes—a kink and/or adhesions; (*b*) that due to internal causes, namely, foreign bodies, including fecaliths (4). It is in the latter group that we are especially interested because the more severe complications occur following rupture of the appendix due to obstruction by a fecalith; that is, an internal obstruction. The actual blocking of the lumen is considered only the precursor of the obstruction of the lymphatic and blood supply which produces gangrene of the appendiceal wall (4, 5).

The demonstration of appendiceal coproliths which contain enough calcium to be visible radiographically is important not *per se*, but for the implications inherent in their presence. Since the nidus or inspissated fecal collection (which forms

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

The cases reported were seen at the U. S. Naval Hospital, Oakland, Calif., and in the Department of Radiology, Stanford University Medical School, San Francisco, Calif., and the Palo Alto Clinic. The opinions and comments are those of the author and do not in any way represent official opinions or reflect the views of the Navy Department.

[2] The word coprolith (dung stone) is used in this article to emphasize the radiopacity of the fecalith or enterolith described. In the older literature, the words fecalith and concretion are used liberally to mean an inspissated fecal collection in the appendix. Many of these contain only small amounts of calcium, but a few can be dignified by the term calculus or coprolith.

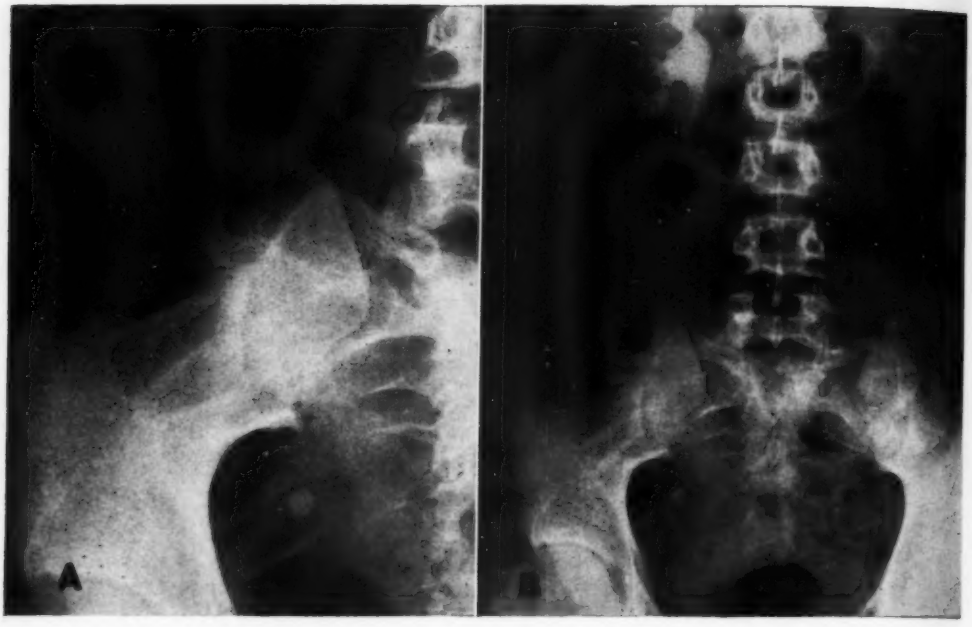

Fig. 1. Case I. A. The spherical, dense, laminated 7-mm. coprolith is seen overlying the right side of the posterior pelvic space (lamination not clearly visible in reproduction).
B. Because the patient had 1–2 red blood cells in his urine, an excretory urogram was done and the ureter can be seen just lateral to the coprolith.

the center of a coprolith) with inspissated mucus and cellular debris has remained in the appendix long enough to become calcified, the possibility (and probability) of internal obstruction is present and, like a gallbladder which contains stones, the wall of the appendix shows chronic inflammation (6), which may make it more likely to be perforated (7). Vaughan (8) agrees with this and states that the important point to bear in mind is that the concrement and perforation bear a cause-and-effect relationship.

In the literature, one finds enough isolated instances (6, 9, 10, 11) of recurrent pain and recurrent appendicitis caused by appendiceal coproliths to warrant further emphasis on the calcifications in the right lower abdomen which too often go unclassified or unmentioned. Shelley, for example, reported a case (12), which has been abstracted in the *Year Book of Radiology*. The succinct words of the abstract bring out the points well: "He states that, had a diagnosis of the condition been made from a roentgenogram made more than four months before the onset of the attack of acute suppurative (perforating) appendicitis, the patient would have been spared the ordeal through which he went and which almost cost him his life." (See also Case IV, below.) Steinert *et al.* (13) write: "When appendiceal concretion is demonstrated by roentgenologic examination as a secondary finding, there is possibly reason for suggesting prophylactic appendectomy, even if at the moment the patient has no symptoms from appendicitis." Tripodi and Kruger (14) express themselves in even stronger terms, on the subject of appendiceal lithiasis: "When definitely diagnosed, surgery is indicated, as a superimposed acute inflammatory process with perforation may occur as a major complication."

Coproliths may be single or multiple and must be differentiated from gallstones, urinary calculi, mesenteric calcifications.

phleboliths, retained radiographic medium, and even calcified appendices epiploicae (33). If the suspicious shadow has a laminated structure (Figs. 3 and 4) which is extrinsic to the urinary tract and out of the pelvis (away from the usual location of phleboliths), the possibility of an appendiceal coprolith must be kept in mind. With such evidence, the decision to operate could be made even in the face of subsiding symptoms or an atypical history. If the roentgenogram reveals an opacity in the right lower quadrant overlying the usual course of the urinary tract, operation may be delayed pending the results of a urogram (15, 16, 17), especially if the findings in the urine are questionable (Case I; Fig. 1). The differential diagnosis is not complete without the exclusion of gallstones (16), as the gallbladder may occasionally be abnormally low or the cecum with the appendix may lie unusually high (Figs. 2 and 4). Phleboliths can usually be differentiated from an appendiceal concretion by the character of the calcification. The phlebolith is usually uniformly calcified and rarely contains concentric layers. The phlebolith is practically always spherical while the coprolith is not necessarily so. The immobility and the pelvic location of the phleboliths are further differential points.

Most calcifications in the abdomen, if at all irregular and not overlying the biliary or urinary tract, are accepted as calcifications in mesenteric nodes, but care should be taken not to overlook an appendiceal coprolith. The irregular character of the calcification in a mesenteric node, coupled with its mobility, makes confusion with an appendiceal coprolith unlikely if one is cognizant of the need for differentiation.

How often are appendiceal fecaliths opaque enough to cast a roentgen shadow? Steinert *et al.* (13), in a recent study of 104 roentgenograms of patients with acute appendicitis, found that in 10 per cent of the cases there were fecaliths containing enough calcium to be demonstrable roentgenographically. The general incidence of fecaliths (calcified or uncalcified) has been estimated by various authors (Graham and Guthrie, 18; Bunch and Adcock, 19; Aschoff 20) at 60 per cent. In one series (13) 30 per cent of the appendiceal fecaliths were sufficiently opaque to show on roentgenograms of the abdomen. Roentgenographic studies of fecaliths found on routine pathological study of surgical and autopsy material at Stanford and San Francisco Hospitals have clearly demonstrated that the vast majority contain calcium, but only 25 per cent appear to be opaque enough to be seen on an abdominal film.

Fig. 1. C. A roentgenogram of the partially barium-filled cecum shows a defect on its posterior inferior portion, and lying in the center of the defect the coprolith (between the arrows), partially obscured by the barium. The irregular collection of barium at the base of the lowest of the small arrows probably lies in the abscess pocket found at surgery.

Archibald found 22 concretions in the appendix in 41 cases of perforation, but only 3 in 38 non-perforating cases. Bowen discovered concretions in 80 per cent of "abscessing" or gangrenous appendices and in only 9 per cent of catarrhal appendices (7).

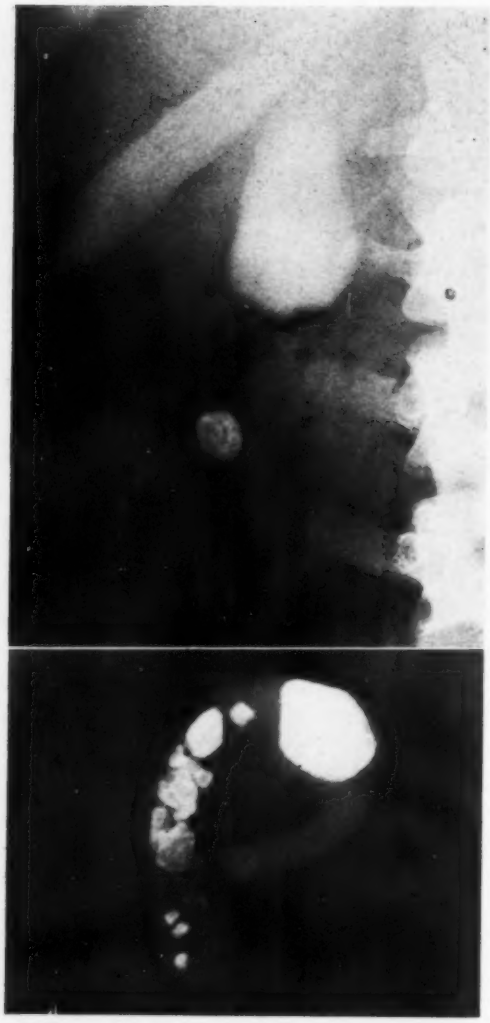

Fig. 2. Case II. The large, 14-mm. laminated coprolith and multiple (15) smaller coproliths are shown as they were discovered at the time of the gallbladder study. A urogram demonstrated that the opacities were outside the urinary tract. A barium enema study showed their constant proximity to the cecum. The appendix could not be filled. The roentgenogram of the appendix after removal with the multiple coproliths demonstrates their character and their relationship to one another.

CASE HISTORIES

CASE I: On Feb. 4, 1945, J. F. G., a 17-year-old white boy was seized suddenly with steady midabdominal pain, not cramp-like in nature. He complained of nausea and vomited about ten hours later. On admission to the hospital, Feb. 6, he was obviously ill, restless, and trying to find a position to relieve the pain. His pulse was 92, temperature 100.6°. The abdomen was moderately rigid, with more resistance on the right. There was moderate rebound tenderness referred to the left side of the abdomen, and peristalsis was present. A rectal examination was negative. Examination of the head and chest revealed no disease. The white blood cell count was 23,000 (82 per cent polymorphonuclears, 25 per cent banded forms). The urine showed 1–2 rbc/hdf.

Impression: Acute inflammatory process in the abdomen, probably appendicitis.

The patient was treated conservatively because the diagnosis was uncertain, the course was at a standstill, and penicillin was available.

Pain and tenderness gradually subsided. After three weeks' observation, x-ray examinations were completed (Fig. 1). On March 6 an appendectomy was done. Adhesions were found in the right lower quadrant and severed. The cecum was mobilized, and the base of the appendix found. The detached tip of the completely divided appendix was seen. A small abscess containing a coprolith was connected with the cecum through a fistula. The stump and tip of the appendix were removed, and the hole in the cecum repaired. The abscess was drained after removal of the coprolith. The patient was returned to duty on April 19, after a thirty-day leave, three and a half months after entry.

The coprolith was very hard and could not be crushed with a curved clamp. Histologically the wall of the appendix was found to be thickened, with hypertrophy of the musculature, and infiltrated with round cells.

CASE II: On March 12, 1945, O. C. A., 33 years old, entered the hospital, reporting that on Feb. 27 his shipmates had told him that his skin was yellow (jaundiced). He had had a severe headache with other minor prodromal symptoms for two to three days prior to this.

Physical examination revealed yellow sclera and skin. The liver was palpable and slightly tender. Liver function tests and the clinical course pointed to a mild attack of hepatitis, recovery from which was rapid. To complete the work-up, a cholecystogram was obtained on May 16, and the roentgenologist reported a normally functioning gallbladder and "multiple calculi" in the appendix (Fig. 2). This was followed by excretory urography and a barium enema study to verify the location of the coproliths.

When a more detailed history was taken, emphasizing the colicky type of pain, it was discovered that there had been recurrent attacks of right lower quadrant pain of a minor nature for two or three years. An appendectomy was done on June 19, 1945. The postoperative course was uneventful, and the patient was sent back to duty on July 19.

The muscular wall of the appendix was remarkably thickened, especially over the largest coprolith. The lymphocytic infiltration of the wall was only moderate.

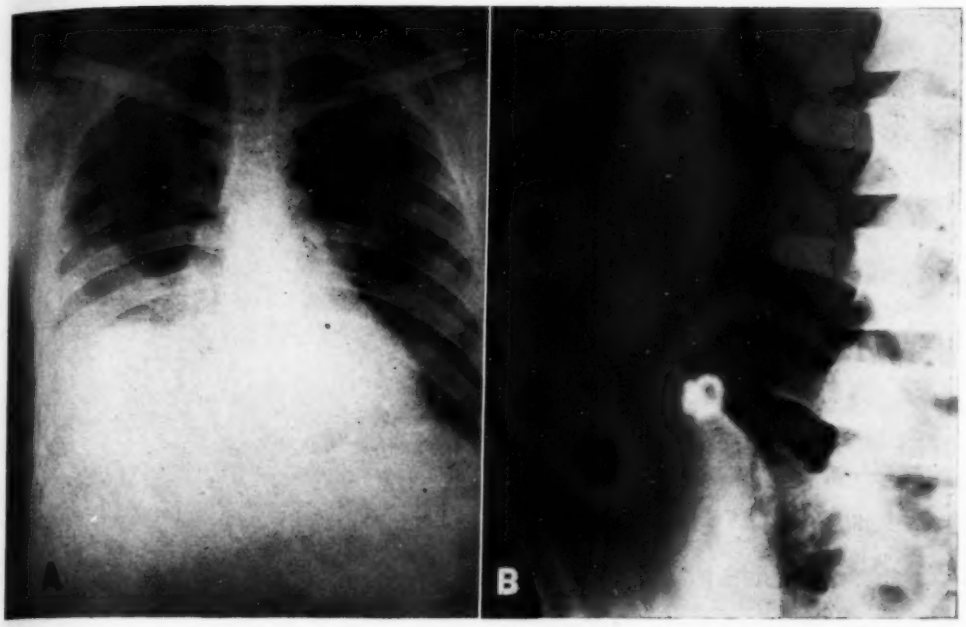

Fig. 3. Case III. A. Roentgenogram of the chest made overseas at the time the patient had a pleural effusion secondary to the subphrenic abscess. Note the elevated right leaf of the diaphragm.
B. The large, 20-mm. laminated coprolith with the smaller, 7-mm. coprolith lying more superiorly. An excretory urogram demonstrated the course of the ureter medial to the opacities.

CASE III: W. B., 24 years old, was admitted May 14, 1945, from an overseas hospital. His health record of March 27, when he was first hospitalized, pictured a very ill young man with an erysipeloid lesion over the abdomen, a high fever, and leukocytosis. A pleural effusion developed, (Fig. 3, A) and finally, after three weeks, an obvious subphrenic abscess was diagnosed and drained (April 19). It was described as being posterior to the liver. Cultures were made and *E. coli* and *B. proteus* were reported.

Upon the patient's arrival at this hospital, the abdominal wound was still draining and occasionally there was a low-grade fever. After the initial white blood count of 12,000 dropped to 9,600, with differential counts showing a slight shift toward the left, examination directed to the cause of the subphrenic abscess was started. A roentgenogram of the chest revealed almost complete clearing of the pleural effusion and only slight elevation of the right leaf of the diaphragm. In a roentgenogram of the abdomen, 2 opacities were seen in the right lower quadrant (Fig. 3, B), and appendiceal coproliths were suggested by the roentgenologist. Further studies, including an excretory urogram and barium enema examination (Fig. 3, C) were done. It was only after the suggestion of appendiceal coproliths was made that the ward medical officer elicited a history of abdominal pain in 1942, when the patient had intermittent cramp-like pains, severe enough to cause him to "double up." The most severe attack lasted two weeks, when he was in bed with almost persistent abdominal pain. He had no further complaints until his present illness, when, on March 30, 1945, five days after the onset of the erysipeloid skin lesion, he experienced abdominal pain which became localized in the right lower quadrant.

In retrospect, it was postulated that he had a perforated appendix, masked by the acute skin lesion. The subsequent course bears this out, and at operation, Aug. 7, 1945, an inflammatory mass due to an old abscess was found, and remnants of the appendix with the coproliths were also removed. On Aug. 11, a secondary closure of the wound was done. The postoperative course was uneventful and the patient was discharged to duty on Nov. 28, eight months after first entering the sickbay.

Histologically, the remnants of the appendix showed evidence of chronic inflammation. The two coproliths consisted of hard shells of calcium salts around a nidus of fecal material, cellular debris, and inspissated mucus.

CASE IV: J. Q. P., 56-year-old retired business man, was first seen by Dr. Dwight L. Wilbur on March 8, 1938, for a general check-up. His symptoms were vague and referable to practically every organ system, but his greatest concern was about his

Fig. 3. C. A barium enema study shows the medial displacement of the cecum and its relationship to the opacities. A barium enema study done after operation showed that there was still slight displacement of the cecum, but the opacities were gone. The displacement of the cecum was due to a large inflammatory mass.

blood pressure, which had been 170 mm. Hg three years before. His prominent complaint, other than nervousness, irritability, and apprehension, was "a rumbling sensation and gas in the stomach." Examinations revealed a well preserved man for his years but no positive physical findings. Laboratory studies, including urine and blood examination, were not unusual. ECG changes suggested minimal myocardial damage.

On May 13, the patient complained of bouts of gas, but this was only one of a myriad of complaints. A barium enema and gastro-intestinal series revealed a large coprolith in the right upper quadrant adjacent to the hyperrotated cecum (Fig. 4) but, because he was such a complainer, it was deemed wise not to mention this to the patient at the time.

On Aug. 10, there was a sudden onset of pain in the right side of the abdomen. This persisted for forty-eight hours and was described by the patient's physician as a typical severe attack of appendicitis, with high fever (103°) and rather diffuse physical findings in the right side of the abdomen. No masses were palpable. A diagnosis of acute appendicitis was made, and at operation the physician found a large mass in the right upper quadrant. The entire mass, which included the terminal ileum, cecum, and appendix, was freed and left on the abdominal wall. A diagnosis of carcinoma of the cecum was made on gross inspection.

The following day Dr. Emile Holman was called in for removal of the exteriorized loop. He resected the mass and with it a portion of the terminal ileum, cecum, and appendix, and performed a side-to-end anastomosis of the ileum and ascending colon. The patient was slow to get back on his feet, but his postoperative course was not unusual.

The true nature of the mass was not appreciated until the specimen was opened by Dr. David A. Wood, and a large 3.0 × 1.5-cm. appendiceal coprolith was found in an abscess contiguous to the perforated, dilated appendix. The inflammatory nature of the whole mass became apparent, and microscopically no evidence of malignancy was found. The wall of the appendix was thicker than normal due to an increase in the muscular layer as well as to infiltration with leukocytes.

CASE V: D. A., a 6-year-old girl, was brought to San Francisco Hospital on Aug. 27, 1942, by her mother, who said that the patient had been vomiting for six days. On Aug. 21, she had a sudden lower abdominal pain. No nausea or vomiting ensued. The next morning, because she had no bowel movement, her mother gave her castor oil, milk of magnesia, and "green pills" without visible results. The following day the child started to vomit; the pain and obstipation persisted. She was believed to be "feverish" for at least two days.

On physical examination, the patient appeared apprehensive, lying on her right side, doubled up, complaining of a "stomach-ache." Her temperature was 101.4°, pulse 128, respirations 28, blood pressure 110/60. The skin was hot and dry. Examination of the chest revealed no dullness or râles. The heart showed no abnormalities. The abdomen was tense, with a firm mass filling the entire right lower quadrant and extending beyond the mid-line to the left. Rectal examination disclosed a large, boggy, tender mass in the mid-line.

Blood studies showed 70 per cent hemoglobin and a white cell count of 17,000, with 78 per cent neutrophils, 10 per cent of which were banded forms. The urine was negative. An x-ray examination of the abdomen revealed a large soft-tissue mass filling the pelvic space.

Impression: Acute appendicitis with perforation and a pelvic abscess.

The patient was treated with fluids parenterally and hot compresses to the lower abdomen and kept in a high Fowler's position. For two days she was observed and parenteral fluid administration was continued. On Aug. 29, the pelvic mass had become fluctuant. An abscess was drained rectally yielding 350 c.c. of pus, in which the predominant organism was *E. coli*. A Penrose drain was left in the abscess for two days. Sulfathiazole was given and the temperature began to fall, reaching normal four days later, when treatment was stopped. A

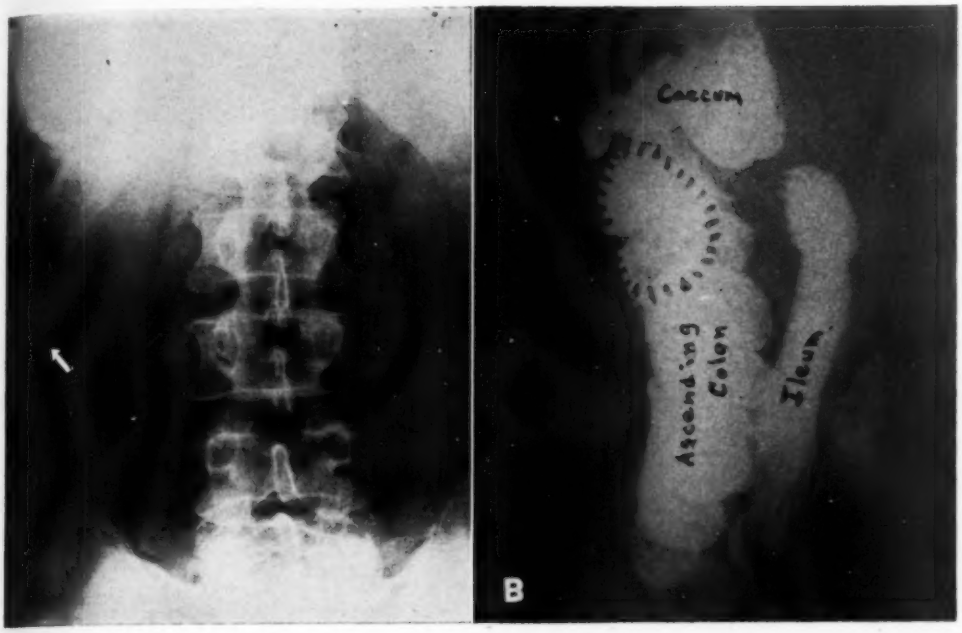

Fig. 4. Case IV. A. A large, oval, 3 × 1.5-cm. laminated cigar-shaped coprolith is seen high in the right side of the abdomen.
B. Six-hour examination made during a gastro-intestinal series demonstrates the malrotation of the cecum and the relationship of the cecum and ascending colon to the large coprolith.

transfusion was done on Sept. 9, and iron was given orally thereafter, because of a moderate anemia. The child improved rapidly, and on the twenty-second day of hospitalization (Sept. 17) she was discharged to the out-patient department.

The patient was followed bi-weekly until Nov. 30, 1942, when she re-entered the hospital for an interval appendectomy. Her only complaint then was intermittent pain in the lower abdomen and legs. Physical examination revealed no positive findings, and the blood count and urine were normal. A barium enema on Dec. 4 revealed a "fecalith" in the appendix (Fig. 5). Operation was done the following day. The tip of the appendix was adherent to the terminal ileum, and a fecalith could be felt in the mid portion. The appendix was removed. On pathological (and radiological) examination of the specimen, a firm (but crushable) fecalith was felt and seen in the mid portion, measuring 1 × 0.7 × 0.5 cm. On cut section (and by x-ray) an irregular laminated pattern of calcium was observed in the fecalith (Fig. 5). The mucosa that remained (about two-thirds of the circumference) over the fecalith showed fresh hemorrhage, and the appendiceal wall was infiltrated with lymphocytes. There were marked fibrosis of the submucosa and hypertrophy of the muscular wall. In other words, the appendix showed real evidence of chronic inflammation and hypertrophy.

CASE VI: R. M., a 13-year-old boy, entered the hospital on Dec. 9, 1945, complaining of pain in the right lower quadrant for six hours, which was sudden in onset. Actually, the pain originated in the right upper abdomen and radiated down into the right leg. There was no nausea, dysuria, diarrhea, or constipation. The temperature was 102°, pulse 88. On physical examination the abdomen was normal, but the right thigh was tender. There was limitation of motion of the right thigh and spasm of the muscles (rectus femoris and adductor group).[3] Reflexes were intact and equal. Several blood studies revealed no leukocytosis (5,250–9,000 white cells with a normal distribution); the sedimentation rate was 16 mm./hr. The urine was negative.

Because of the indefinite pain in the leg, it was felt that spinal cord irritation should be ruled out, and a lumbar puncture was done. The spinal fluid was negative. The following day, on further questioning, a history of vague bouts of right lower quadrant pain was brought to light.

A series of roentgenograms were taken of the right hip. The bones of the pelvis and hips were negative, but it was noted that there was an opacity in the lower right quadrant that remained in constant relationship to the gas in the cecum (Fig. 6). An appendiceal coprolith was suggested. The patient

[3] This is described as a sign of appendicitis (21).

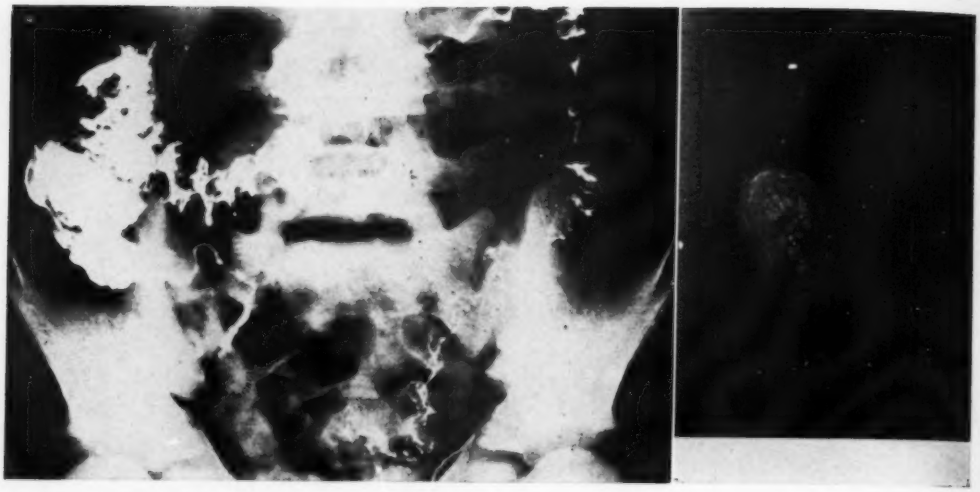

Fig. 5. Case V. The after-evacuation barium-enema film shows the appendix partially filled. The barium ends in a curvilinear shadow and below this a faint opacity can be seen. A roentgenogram of the specimen demonstrates the beginning laminated pattern of the incomplete calcification of the fecalith.

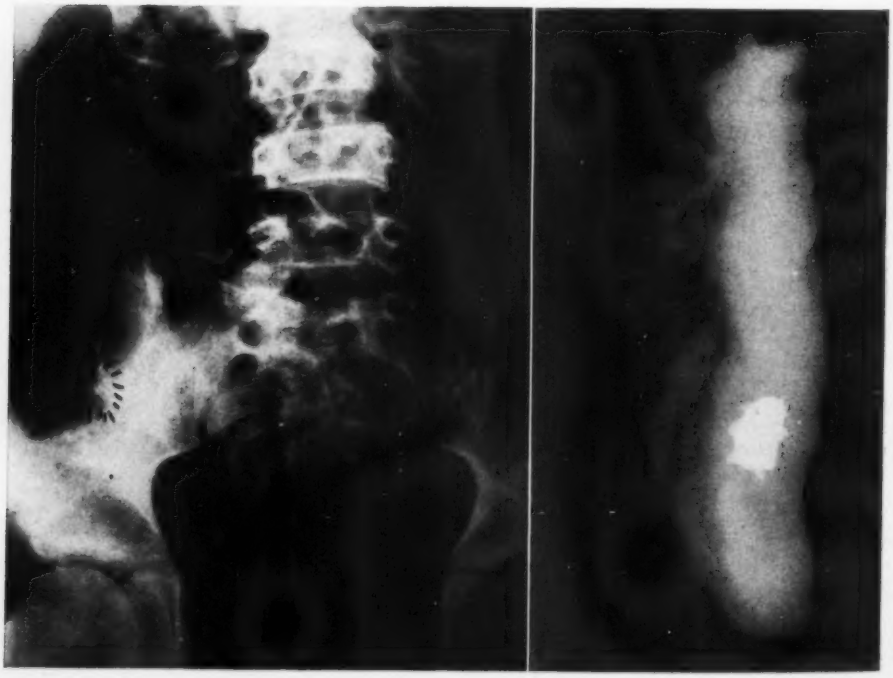

Fig. 6. Case VI. The dense coprolith can be seen in the right lower quadrant. This remained in constant relation to the gas-filled cecum. A roentgenogram of the specimen demonstrates the density of the opacity and one other fecalith in the tip which contains calcium, but this one could not be seen in the roentgenogram of the abdomen.

recovered from the acute episode quickly and was discharged. He returned to the out-patient department on Dec. 31 and reported being well since his discharge. He was brought into the hospital for operation (appendectomy) on Jan. 25, 1946. A normal appearing appendix was removed, containing an oval, hard concretion near the tip, with a smaller and softer "fecalith" palpable in the lumen (Fig. 6). The postoperative course was not remarkable, and the boy was discharged well on Feb. 7.

Histologically the wall of the appendix was thick, due to hypertrophy of the musculature, and there was infiltration of the wall with lymphocytes.

COMMENT

While the roentgenographic demonstration of coproliths in the appendix is not new (9, 11, 12, 13, 15, 22, 23, 24), the significance of the opacities in the right lower quadrant is brought to the attention of the radiologist, especially as an aid in the diagnosis of appendicitis in patients with recurrent attacks of right lower quadrant pain. In turn, the recognition of the significance of the opacities should lead to operative removal (13, 14, 25, 26) and a decrease in the morbidity (or even mortality) of this ubiquitous disease. This is doubly emphasized by a review of Case III, where the history of appendicitis was brought out only after the radiologist pointed out the appendiceal coproliths. Note should also be taken of the great length of the patient's incapacitating illness—eight months. The importance of removal of these coproliths is further demonstrated by Case IV, in which the physician, in spite of his knowledge that a large calculus was present, did not suggest its removal, and only after an acute attack of inflammation of the appendix with rupture was operation done.

Inferentially, then, it is more important to remove an appendix containing stones than it is to remove a gallbladder containing stones, as rupture of the appendix is imminent, while rupture is an unusual complication of gallbladder disease.

The amount of calcium and the degree of hardness of the calculus are undoubtedly dependent upon the age of the fecalith. In Case V, in a patient only six years old, the amount of calcium was very small. It is estimated as being approximately the smallest amount demonstrable roentgenographically, even in a very thin person, and would be completely lost in an adult of normal weight (thickness). Kelly (27) reported a well developed concretion in a child of three and a half years of age. In Case IV the amount of calcium was large and the stone tremendous, being almost as large as any yet reported (29). In Case I the calculus was remarkable for its hardness, as it could not be crushed with a clamp, and it, too, was very opaque and laminated and must certainly have been many years old.

The origin and pathology of these coproliths have not been discussed here, as the subject has been well covered in many texts on appendicitis (27, 30, 31). The first mention of an appendiceal coprolith was in 1813 by Wegeler (32), who likened the concretions to gallstones.

One of the points emphasized by Pilcher (29) is the hypertrophy of the muscle wall of the appendix, which was noted in five of our six cases. This has not been brought out before and may be the mechanism of the intermittent colic, the history of which can be elicited after the presence of the calculus is discovered (Cases II, III, and VI). Shahan (25), in his case, also mentions "thickening" of the appendix, which contained 23 "hard stones." His patient recovered completely, symptomatically, following removal of the stone-filled appendix.

Since the inception of this paper, the diagnosis of appendiceal coproliths has been made an additional 8 times, with 2 more proved cases. One patient had had numerous bouts of abdominal pain with no recurrence of pain postoperatively to date (two months). The other patient entered in a very poor condition and the coprolith could be seen in a soft-tissue density which displaced the gas-filled bowel out of the right iliac fossa and ultimately proved to be a large abscess secondary to a ruptured appendix. Two of the most recent cases were similar to those reported by Seelig (15) and Mascherpa

(17), as the presenting symptoms were referable to the urinary tract.

This is not an attempt to popularize the needless operation for the impossible roentgen diagnosis of chronic appendicitis; but it is an attempt to explain on a mechanical basis one of the causes of complications of appendicitis and to show that, although the roentgenologic diagnosis of chronic appendicitis has proved unsatisfactory even in the best of hands (26), a number of patients may be saved the needless chance of an attack of appendicitis with the complications herein reported.

SUMMARY

1. The importance of the diagnosis of appendiceal coproliths is emphasized, especially since it is believed that such a diagnosis warrants operative intervention.

2. Six cases of appendiceal coproliths are reported, in four of which the seriousness of the disease following rupture of the appendix is exemplified.

3. One of the four largest coproliths yet reported—3.0 × 1.5 cm.—is included in this small series.

4. When the diagnosis of "chronic appendicitis" is entertained, a roentgenogram of the abdomen with the patient supine should be made to rule out the possibility of a calcified appendiceal coprolith. But one must remember that the diagnosis of chronic appendicitis is impossible roentgenographically. It is only inferred that, when a clear-cut history fits with the roentgenographic diagnosis of an appendiceal coprolith, operation for chronic recurring appendicitis will yield benefits.

Palo Alto Clinic
Palo Alto, Calif.

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DISCUSSION

John H. Camp, M.D. (Rochester, Minn.): Dr. Thomas referred or said someone referred to this subject as old stuff. Perhaps it is, but the older one gets in the practice of medicine, the more he realizes that there isn't so much that is actually new, anyway. If we go back far enough in the old literature, especially in Virchow's *Archives*, we frequently find things that some of us get excited about these days because they appear new. Nevertheless, many of them take on increased significance because of advances in diagnosis and the increase in our knowledge of various clinical phenomena.

I was fortunate enough to have Dr. Thomas as one of my assistants during my Navy career, and our experience in seeing a few cases of appendiceal coproliths emphasized, at least to me, the importance of these shadows in the lower right quadrant.

I am sure that Dr. Thomas doesn't want to leave with you the idea that the presence of such a shadow justifies a diagnosis of appendicitis on the part of the radiologist. Rather, I think it should emphasize that in a patient who is having recurrent right lower quadrant symptoms we should seriously consider appendiceal disease and the surgeon should be on the alert for the discovery of the condition and its complications.

The presence of coproliths in the appendix is important because, as these cases emphasize, when the patients are allowed to continue with recurrent attacks of appendicitis, serious complications may result. If we can help avoid these by contributing this little roentgenologic bit, I think this review of so-called "old stuff" has justified itself.

Paul C. Swenson (Philadelphia, Penna.): I would like to ask Dr. Thomas one question. Has he found the origin for the calcium in these lumps?

Dr. Thomas (*closing*): Dr. Swenson has asked concerning the formation of the coproliths. It is believed that their formation may be similar to that described by Phemister *et al.* in the *Annals of Surgery*, in October 1931 and 1932. In these articles, it is postulated that stones of high calcium carbonate content are formed only after obstruction of the gallbladder. Because most of the appendiceal coproliths contain a high percentage of calcium carbonate, the same mechanism probably exists.

SUMARIO

Coprolitos Apendiculares: Su Importancia Quirúrgica

Recálcase la importancia del diagnóstico de los coprolitos apendiculares, en particular por creerse que ese diagnóstico justifica la intervención cruenta.

Comunícanse seis casos, en 4 de los cuales pónese de manifiesto la gravedad del estado cuando sobreviene perforación del apéndice. Esta pequeña serie comprende uno de los 4 mayores coprolitos descritos hasta ahora: 3.0×1.5 cm.

Cuando se considera el diagnóstico de "apendicitis crónica," debe hacerse una radiografía del abdomen con el enfermo en posición supina, a fin de excluir la posibilidad de coprolitos apendiculares calcificados, pero recordando la imposibilidad de hacer roentgenográficamente el diagnóstico de la apendicitis crónica. Sólo cabe colegir que, cuando una historia bien definida concuerda con el diagnóstico radiográfico de coprolito apendicular, resultará beneficiosa una operación por apendicitis recurrente crónica.

Problems in the Diagnosis of Cancer of the Colon[1]

KENNETH S. DAVIS, M.D., and WILLIAM H. DANIEL, M.D.
Los Angeles, Calif.

WE CANNOT view with complacency the fact that almost a year has elapsed before the average patient with cancer of the colon has an accurate diagnosis made. Furthermore, there are no symptoms which can be designated as distinctive of a malignant growth of the colon, these varying widely, depending on the location and the gross form of the tumor and on the presence or absence of complicating factors such as ulceration, perforation, obstruction, secondary infection, and hemorrhage.

The colon is the site of many other pathological processes which resemble cancer in their clinical and roentgenologic manifestations. Many patients are operated on for appendicitis only to have a cancer in the proximal colon disclosed. Ileocecal tuberculosis and regional enteritis may also simulate carcinoma. In the distal colon, diverticulitis, especially with an inflammatory mass, often cannot be differentiated from cancer. In the rectum, operations are frequently done for hemorrhoids only to have a cancer disclosed at a later date.

SYMPTOMS

Cancer of the Colon: According to Rankin, it is impossible to correlate symptoms and signs referable to the entire colon as if it were a single organ, because of the wide differences in the proximal and distal portions, both structurally and functionally. On his basis of symptomatology, cancer in the proximal colon may be divided into three groups: (1) the dyspeptic group, usually diagnosed as chronic appendicitis or cholecystitis; (2) the group characterized by unexplained anemia and weakness; (3) the group in which a tumor is discovered accidentally, or in the course of a routine examination. Twenty-six per cent of carcinomas of the cecum and ascending colon falling in Group 1 were diagnosed as appendicitis; 90 per cent of these patients complained of pain and soreness in the lower right quadrant of the abdomen from two to nine months before exploratory operation. In Group 2, the weakness and anemia are not accompanied by visible bleeding from the rectum. It is in this group that a thorough roentgenographic study is indicated, not only of the colon but of the entire gastro-intestinal tract.

In the distal colon, obstructive phenomena dominate the clinical picture, since cancers in this region tend to be encircling in type, causing progressive stenosis. Furthermore, the fecal content in the left half of the colon is hard and formed and can be forced only with difficulty through a closing segment. A history of progressive constipation can be obtained in from 50 to 60 per cent of these cases.

In acute obstruction of the colon, the symptoms are very similar to those of small bowel obstruction, with marked abdominal distention and evidence of hyperactive peristalsis. In these cases a "scout" roentgenogram of the abdomen is indicated, as it will aid materially in localizing the point of obstruction.

The appearance of bright or dark red blood in the stool, especially if it persists on repeated examinations, suggests the possibility of a cancer distal to the splenic flexure of the colon. Lesions in the proximal colon seldom cause bleeding; if they do, the blood is dark in color and tarry in consistency.

Cancer of the Rectum and Rectosigmoid: Cancers of the rectum may cause early symptoms, but in a majority of cases the

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1-6, 1946.

patient either disregards them or they are misinterpreted. The average duration of symptoms before diagnosis, as given by Rankin, is approximately twelve months. The most frequently encountered symptoms are bleeding and changes in bowel habit; frequent desire to stool, often mistaken for diarrhea, with the passage of blood or mucus, predominates. Loss of weight and strength are worthless symptoms in the early recognition of the condition. To wait for the so-called textbook symptoms to appear, as anemia, loss of weight and strength, palpable mass, etc., is merely to postpone the diagnosis until there is no hope for cure.

DIAGNOSIS

Diagnostic errors in the recognition of cancer of the colon are both of omission and commission. Failure to make a proper examination results in more errors in diagnosis than any other factor. The first point of examination should be the rectum and sigmoid colon, since the majority of cancers of the colon are found in these areas. Seventy-five per cent of cancers of the rectum are within reach of the examining finger; the remainder can usually be visualized through the proctoscope. The digital and the proctoscopic examination should always precede the roentgenological study. Palpation of the rectum should be done in the left lateral position; it is followed by sigmoidoscopic examination in the inverted position if the instrument cannot be passed the desired length while the patient is lying on the side.

If a definite advanced lesion is found by palpation and visualized through the instrument, x-ray examination is usually unnecessary. If the lesion is annular and obstructing, the use of the barium enema is contraindicated, since a partial obstruction may be converted into a complete one by the barium.

If a non-obstructing lesion is seen by the proctologist and symptoms of obstruction are present, a barium enema study should be done, as it may show a second lesion in another segment of the colon, multiple growths being not uncommon. The barium enema should always precede the oral meal for two reasons: (1) Barium by mouth is dangerous in the presence of an obstructing lesion and may produce an acute obstruction. (2) The motor meal study is of far less value in ruling out an organic lesion, owing to the irregular distribution of the barium throughout the lumen of the colon.

If one or more polyps are found in the proctoscopic study, the air-contrast barium enema as employed by Weber is essential, since polyps are often multiple.

If blood is a constant finding in repeated examinations with the sigmoidoscope and all local causes are ruled out, the plain barium enema followed by an air-contrast study is essential. This should be repeated several times if the findings are negative or indeterminate. In the event that no lesion is demonstrated by the x-ray and blood continues to be present, an exploratory operation is justified.

The sigmoid colon can well be termed the silent area of the gastro-intestinal tract, as it frequently drops downward behind the upper rectum and in some instances cannot be visualized, regardless of the position of the patient. The enema may pass through a lesion without obstruction and the lesion not be seen. Furthermore, a tumor in the sigmoid may intussuscept into the upper rectum and not be revealed by the barium enema although readily seen through the proctoscope.

Frequent sigmoidoscopic examinations are helpful in differentiating between malignant and inflammatory lesions, especially in the presence of diverticulitis, where the roentgen findings are indeterminate. Bleeding from a diverticulitis is rare, whereas the constant appearance of blood points to cancer.

DIFFERENTIAL DIAGNOSIS

Cancer of the colon accounts for about 70 per cent of required operations on the colon, so that it would seem advisable to consider a malignant growth in the differ-

ential diagnosis unless it can be conclusively proved otherwise.

In the proximal colon, appendiceal abscess, hyperplastic ileocecal tuberculosis, actinomycosis, regional enteritis, and intussusception must be differentiated from carcinoma.

In the distal colon, the filling defect produced by diverticulitis more closely simulates cancer than any other lesion; the filling defect may be due to persistent spasticity or be a true defect resulting from encroachment on the lumen of the bowel by pericolic inflammatory tissue. The differentiation is rendered more difficult with the presence of diverticula elsewhere in the colon.

In chronic ulcerative colitis, the proctoscopic examination, if done by an experienced proctologist, gives the most important data for diagnosis.

Sigmoidoscopic examination should be the rule in cases with symptoms suggesting colitis or dysentery, to exclude carcinoma. This should be followed by the barium enema study. Segmental chronic ulcerative colitis may produce the classic roentgen findings of carcinoma, namely obstruction, filling defect, and palpable mass.

In polyposis of the colon, one should always keep in mind the high incidence of malignant change, especially in cases of diffuse polyposis, and radical surgical treatment should be considered in these cases.

CONCLUSIONS

In the routine examination of the colon, the digital examination should be first, as 75 per cent of cancers of the rectum can be reached by the examining finger. This should be followed by the sigmoidoscopic study. If an advanced lesion is found in this examination, the x-ray study is usually unnecessary.

The barium enema should always precede oral administration of barium, since barium by mouth is dangerous if obstructing lesions are present. If the roentgen findings are not conclusive or if there is a persistence of symptoms, the examination should be repeated.

If one or more polyps are found in the proctoscopic study, an air-contrast barium enema study as employed by Weber should be done, since polyps are often multiple.

If persistent bleeding is found in repeated sigmoidoscopic examinations, surgical exploration is indicated despite negative roentgen findings.

2131 West 3d St.
Los Angeles 5, Calif.

DISCUSSION

Maurice Feldman, M.D. (Baltimore, Md.): A survey of the statistics on failure to diagnose cancer of the colon is not available at the present time. Errors in the roentgen diagnosis, however, are common to all roentgenologists. Our goal should be to keep these errors to a minimum.

It is noteworthy that at times the roentgen examination of the colon is misleading and for that reason one should not neglect the clinical observations and proctoscopic, sigmoidoscopic, and stool examinations in any case of suspected colonic disease.

The roentgen diagnosis of carcinoma of the colon presents many pitfalls, which Dr. Davis and Dr. Daniel have well outlined. Early and even moderately late cases of carcinoma of the colon may be overlooked or obscured as a result, first, of the site of the lesion; second, over-filling of the area involved; third, overlapping of loops of bowel; fourth, a minimal lesion; fifth, the pathologic type of carcinoma.

To obtain the best diagnostic result the following measures must be utilized:

First, use as thin a barium solution as is possible.

Second, observe the flow of the opaque medium carefully under the fluoroscope.

Third, study the colon in the prone, supine, and oblique positions.

Fourth, look upon any area of incomplete filling or segmental emptying with suspicion.

Fifth, repeat the colon enema in all suspected cases.

Sixth, correlate the clinical manifestations.

Seventh, in all cases of blood in the stools, either occult or visible, where the source in the upper tract has been eliminated, repeated study of the colon is not only necessary but imperative.

I might suggest that the colonic roentgen study be planned in two stages, especially for examination of the lower colon, the rectum, and sigmoid. The first stage is to fill the rectum and partially fill the sigmoid and take a series of films of the rectum and sigmoid only; in the second type, the colon is completely filled. This procedure will eliminate overshadowing of redundant loops of colon, and overshadowing of the terminal ileum.

David G. Pugh, M.D. (Rochester, Minn.): Dr. Davis has ably discussed many problems that are encountered in the diagnosis of carcinoma of the colon. I am especially pleased that he recommended the proctosigmoidoscopic examination as an adjunct to the roentgenologic examination of the colon. The proctosigmoidoscopic examination is the best method of diagnosing lesions of the rectum and rectosigmoid and it is especially valuable in the recognition of inflammatory diseases of the colon if the lower segments are involved. If at all possible, this examination should precede the roentgen examination. Under such circumstances the roentgenologist will need to be concerned only with that part of the colon that is above the proctologist's vision.

If a proctosigmoidoscopic examination is not obtainable, it is necessary to examine the entire colon, including the lower segments, by roentgenologic methods. By use of the customary roentgenologic technic all of the colon that can be palpated—and that includes all but the rectum, rectosigmoid, and varying lengths of the sigmoid—can be satisfactorily examined. In order to examine those lower segments, a double-contrast study must be done. Ordinarily double-contrast studies of the rectum and lower part of the sigmoid are not satisfactory when the upper part of the colon is also examined, since too much fluid remains in the bowel after efforts at evacuation and often there is barium mixture in the terminal ileum. It is therefore usually necessary that a localized air study of the lower part of the colon be done a day or so later. In this way an excellent roentgenologic view of this segment of the bowel can be obtained, but this does not approach the degree of accuracy that is obtained by a proctosigmoidoscopic examination. It seems to me, therefore, that a combination of proctosigmoidoscopic and roentgenologic examination is ideal if a complete study of the colon is desired.

Kenneth S. Davis, M.D. (*closing*): There is one point I failed to mention in my paper. That is, before we give any barium at all by mouth, for whatever reasons, we always take a scout roentgenogram of the abdomen to see if there is any distention with gas. In the presence of an excessive amount of gas we do not give barium by mouth.

SUMARIO

Problemas Planteados por el Diagnóstico del Cáncer del Colon

En la exploración corriente del colon, el examen digital debe ser lo primero, pues 75 por ciento de los cánceres del recto son accesibles al dedo explorador. Luego debe venir el estudio sigmoidoscópico. Si este examen revela una lesión avanzada, el estudio roentgenológico suele resultar innecesario.

El enema de bario debe preceder siempre al bario por vía oral, pues el último es peligroso si existen lesiones obstructoras. Si los hallazgos radiológicos no son terminantes o si persisten los síntomas, hay que repetir el examen.

Si la proctoscopia revela uno o más pólipos, debe ejecutarse un estudio con el neumo-enema de bario de contraste, que emplea Weber, dado que los pólipos son a menudo múltiples.

Si se encuentra hemorragia persistente en exámenes sigmoidoscópicos repetidos, está indicada una operación exploradora a pesar de los hallazgos roentgenológicos negativos.

Effects of Estrogenic Therapy[1] on Osseous Metastases from Carcinoma of the Prostate[2]

WILLIAM C. MacCARTY, JR., M.D.

Associate Radiologist, The Hitchcock Clinic, Hanover, N. H.

THE INCREASING role played by hormonal therapy in the treatment of certain types of malignant growth, especially carcinoma of the female and male breasts and of the prostate gland, has prompted this study. Huggins (1), in his original report on orchiectomy as a method of treatment for carcinoma of the prostate, noted that 15 of his 21 patients who had been treated by orchiectomy had osseous metastases. Of these, he states: "In all cases in which metastases were present, which were followed for long periods, increased osteosclerosis of the metastases was observed within three to six months after castration." Nesbit and Cummings (2) review the results obtained by orchiectomy in 75 patients with carcinoma of the prostate, of whom 31 had osseous metastases. In 4 of 12 cases which were followed six months after orchiectomy, definite regression of the metastases was observed. Alyea and Henderson (3) report that "following castration there is a distinct smoothing and sclerosing of the bone detail, approaching more normal type of bone." Nathanson (4) states that bone metastases may no longer be visible by x-ray, following orchiectomy. Our experience during the past four years closely parallels the work of these investigators.

From 1942 to 1945, inclusive, 67 patients with carcinoma of the prostate gland were treated in the Mary Hitchcock Memorial Hospital. The basis for diagnosis was clinical evidence of the primary carcinoma, with or without osseous metastases, plus a positive biopsy in slightly over half of the cases. The oldest patient in the group was 87 years of age, the youngest 52 years; the average age was 69. The initial symptom in 43 cases was referable directly to the urinary tract. Eleven patients complained of pain of the skeletal type, usually in the pelvis or hips, in addition to the usual symptoms brought about by prostatic enlargement. Nine of the patients complained of bone pain as the only initial symptom. The remainder of the group presented themselves for reasons which at the time were not considered related to prostatic disease.

Biopsy specimens were obtained in all cases requiring transurethral resection for bladder neck obstruction. This procedure was carried out on 37 of the 67 patients. The diagnosis returned from the laboratory was adenocarcinoma in 35 instances and benign hypertrophied prostatic tissue in 2 patients. The latter report is understandable when one considers how little of the entire gland may be removed in alleviating bladder neck obstruction.

At the time this study was carried out, orchiectomy and/or stilbestrol therapy were the procedures of choice in treating carcinoma of the prostate. Orchiectomy was performed 51 times in this series. Most of these patients, in addition, had received stilbestrol prior to surgery or were discharged on a maintenance dose of the drug. Sixteen patients were treated with stilbestrol alone. Transurethral resection was necessary because of bladder neck obstruction in 37 of the entire group. In 13 instances, x-ray therapy had been instituted either prior to estrogenic therapy or was required subsequently to control pain.

Roentgenograms of the lumbar spine

[1] The words "estrogenic therapy" as used in this paper imply orchiectomy and/or the use of the drug stilbestrol.

[2] Accepted for publication in October 1946.

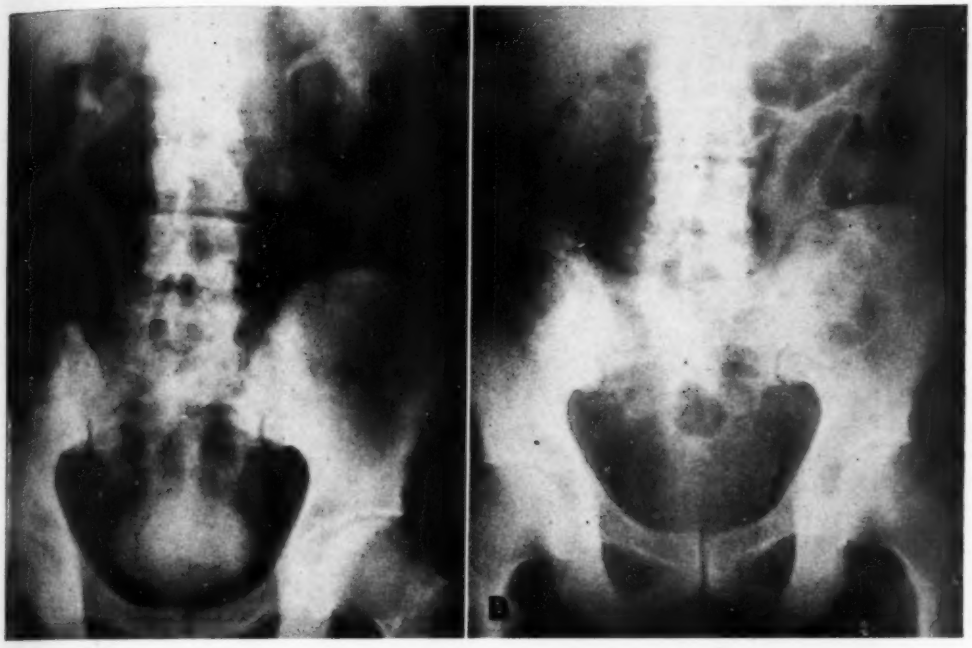

Fig. 1. A. Admission roentgenogram showing osteoblastic metastases involving the lumbar spine, sacrum, pelvis, and upper ends of the femurs.
B. Roentgenogram of same patient five months after institution of stilbestrol treatment, showing a notable decrease in the number and density of the metastatic areas.

and pelvis, separately or in conjunction with intravenous pyelograms, revealed osseous metastases in 29 patients. The predominant type of bone involvement was osteoblastic. In only 2 cases were true osteolytic metastatic lesions demonstrable.

Of the 29 patients showing osseous metastases, 6 were treated by orchiectomy alone, 21 had orchiectomy plus stilbestrol therapy, and 2 were given stilbestrol without castration. Transurethral resection was required in 11 of these cases, while 10 had x-ray therapy either before or after admission for treatment.

Table I outlines the changes noted in the appearance of the osseous metastases following estrogenic therapy. In 3 patients, demonstrable osseous metastases developed some time after estrogenic therapy had been instituted (ten months, sixteen months, two months). In 2 instances, there was no notable change in the appearance of the metastatic areas at follow-up examination. In 4 cases the osseous metastases progressed unchanged in spite of therapy; in 5 they became more dense and more discrete.

TABLE I: X-RAY CHANGES IN METASTASES FOLLOWING ORCHIECTOMY AND/OR STILBESTROL THERAPY

Metastases developed	3
No change in metastases	2
Metastases progressed unchanged in character	4
Metastases become more discrete	5
Improved	2
Improved but recurred	1
Disappeared	2
No follow-up	10
TOTAL	29

The follow-up roentgenograms in 2 cases showed definite improvement, evidenced by a diminution in the amount of involvement of the bone. The original configuration of the metastatic area, however, had not changed in character. Figure 1 is an illustration of such a case. The patient was a 74-year-old male who was admitted to the hospital in March 1944, because of vomiting. The clinical diagnosis was carcinoma of the prostate. Roentgenograms

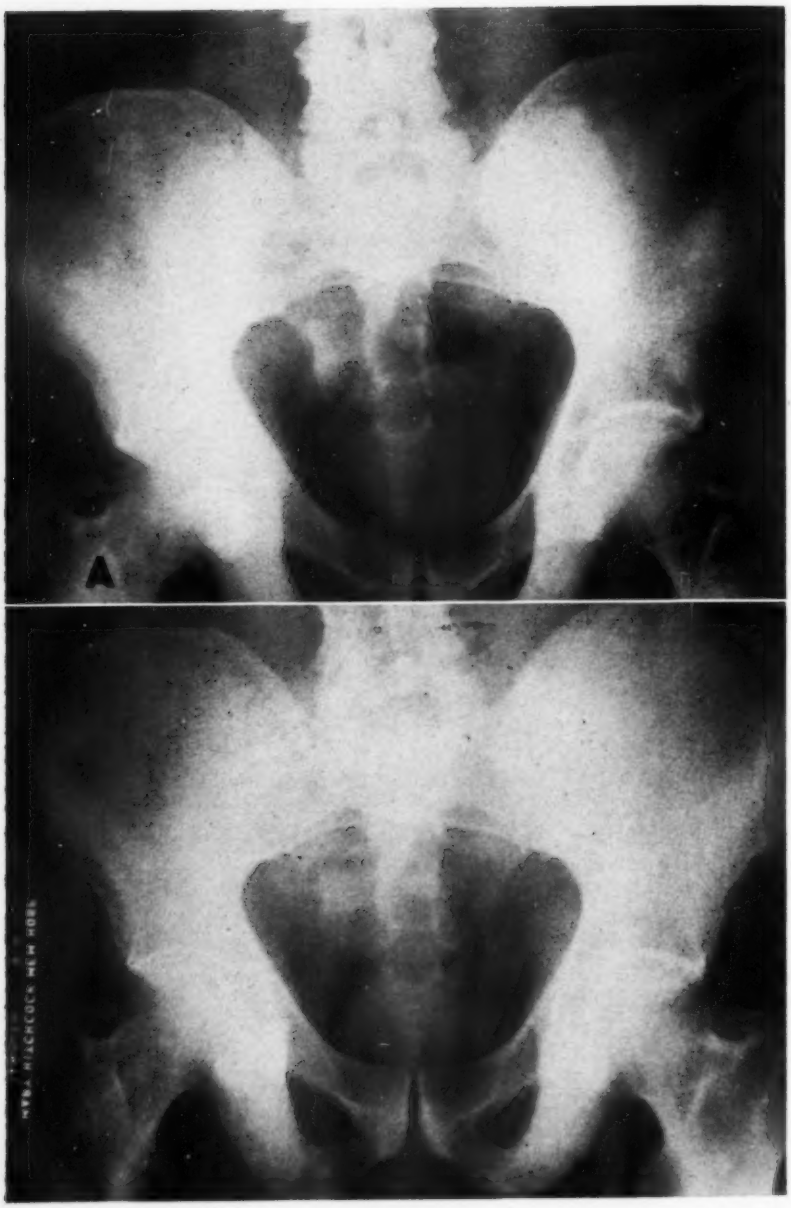

Fig. 2. A. Admission roentgenogram of a seventy-year-old man, showing multiple rounded, irregular areas of varying size throughout the pelvis, representing osteoblastic metastases.

B. Roentgenogram of same patient twenty-two months after institution of estrogenic therapy, revealing practically complete disappearance of the pelvic metastases. See also Fig. 2C.

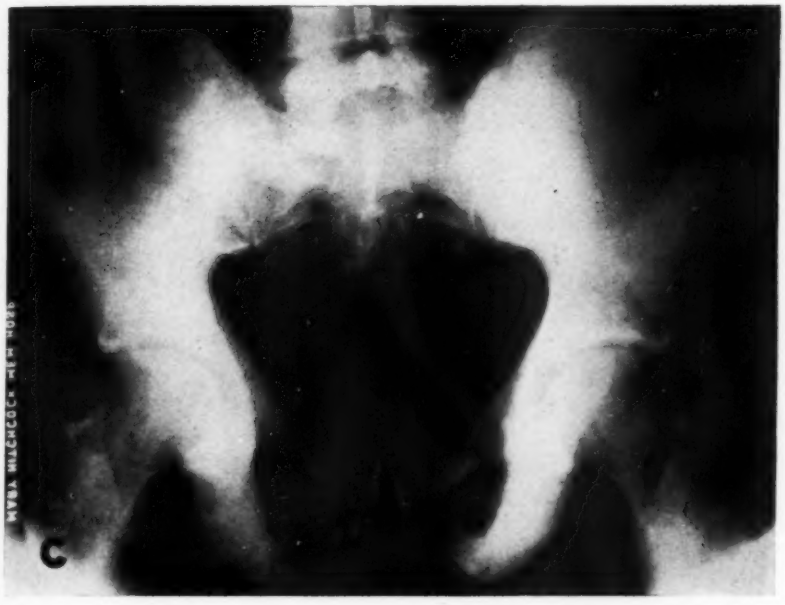

Fig. 2. C. Roentgenogram of patient shown in Figs. 2A and 2B, five months after the metastatic lesions had apparently disappeared. There are now extensive diffuse metastases throughout the entire pelvis.

revealed osteoblastic metastases in the pelvis and lumbar vertebrae (Fig. 1A). Treatment was by stilbestrol alone, with excellent temporary clinical improvement lasting five months. An orchiectomy was performed in August 1944. In spite of temporary symptomatic relief and a noticeable improvement in the appearance of the osseous metastases (Fig. 1B), the patient died in November 1944, eight months after treatment was instituted.

Figure 2 illustrates one of the most unusual changes observed in the metastatic processes and is the only such case in this series. The patient was a 70-year-old man in whose case a diagnosis of carcinoma of the prostate had been established elsewhere in 1941, following a transurethral resection. He had also received x-ray treatment for low back and pelvic pain. He was admitted to our hospital in 1942, complaining of dysuria. Roentgenograms (Fig. 2A) revealed osteoblastic metastases. Orchiectomy was carried out and the patient was discharged on a maintenance dose of stilbestrol. Follow-up roentgenograms revealed no change in the appearance of the metastases in May 1943, but in June 1944 they had practically disappeared (Fig. 2B). When the patient was last seen in November 1944, however, he was failing rapidly, and extensive osteoblastic metastases of a different type from those seen originally were demonstrable (Fig. 2C).

The most striking roentgenographic changes were noted in the two patients in whom we considered the bony metastases to have disappeared. The first of these patients was a 77-year-old male who was admitted in March 1942, with a dysuria of five years' duration. Roentgenograms (Fig. 3A) in conjunction with an intravenous pyelogram revealed an osteolytic process in the left pubic bone. A bilateral orchiectomy was performed as the sole method of treatment. When the patient was last seen, in October 1943, nineteen months later, there had been a complete recalcification and filling in of the metastatic area (Fig. 3B), and he was symptom-free.

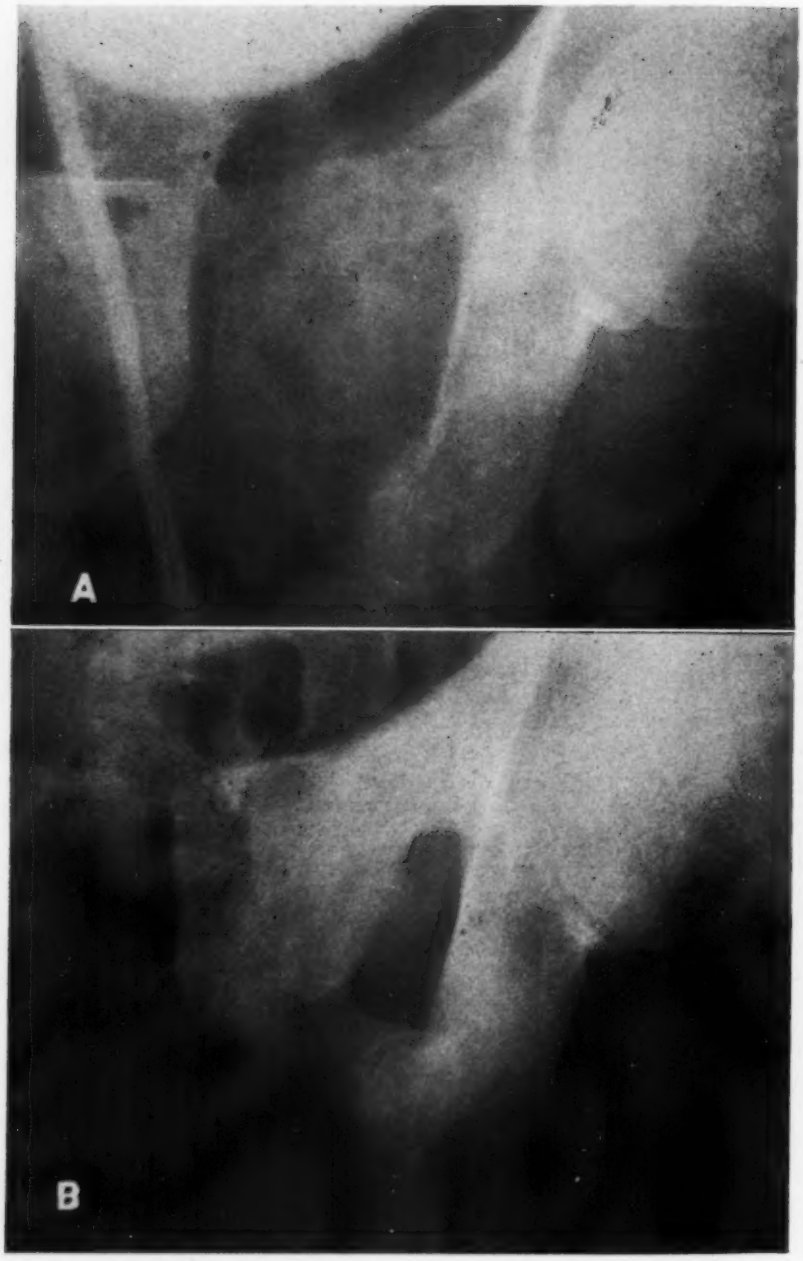

Fig. 3. A. Osteolytic metastatic process completely destroying most of the left pubic bone.

B. Roentgenogram taken nineteen months after orchiectomy, showing complete recalcification and filling in of the metastatic area shown in A.

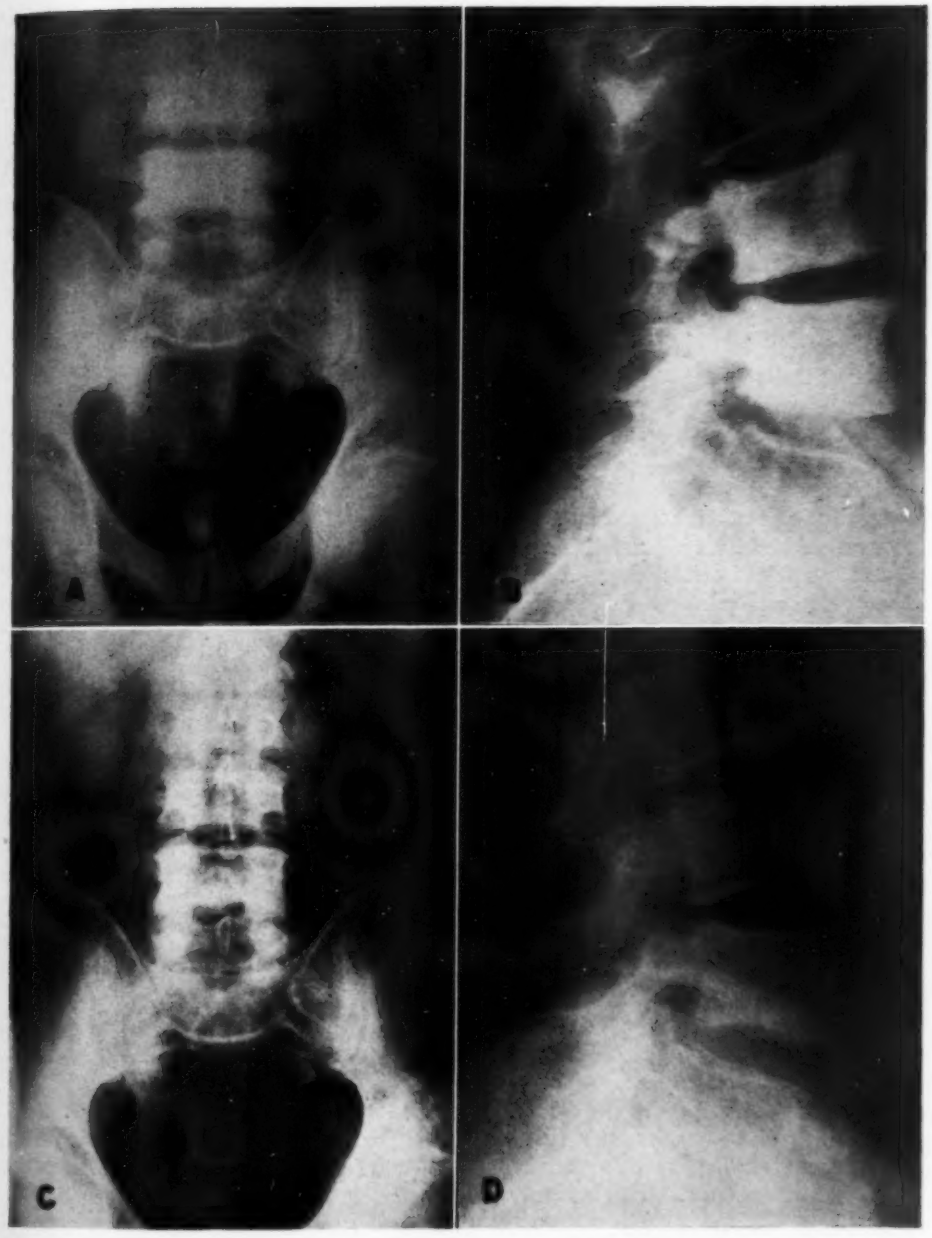

Fig. 4. A and B. Roentgenograms revealing extensive metastases involving particularly the bodies of the third and fourth lumbar vertebrae and the bones of the pelvis.

C and D. Roentgenograms of the same patient taken eighteen months after orchiectomy and institution of stilbestrol therapy. The osteoblastic metastases involving the vertebrae and pelvis have completely disappeared.

The second patient, in whom similar changes were noted, was a 50-year-old male who had had known carcinoma of the prostate for eight years. He had had four previous transurethral resections, the first in 1934, elsewhere, the second and third in our hospital in 1937 and 1938, respectively, and the fourth elsewhere in 1940. In each instance, a diagnosis of adenocarcinoma had been returned from the laboratory. The pathological sections obtained in 1934 were reviewed by our pathologist. Osteoblastic metastases were known to have been present since 1938. A series of x-ray treatments was directed over the pelvis in 1940. In November 1942, the patient was admitted again because of pain in the back and pelvis, as well as dysuria. Roentgenograms taken at the time showed osteoblastic metastases in the lumbar vertebrae and the pelvic bones (Fig. 4 A and B). Orchiectomy was performed and the patient was discharged on stilbestrol therapy. Eight months later he returned for the removal of a bladder stone. No change was noted in the areas of osseous metastases. In May 1944, eighteen months after orchiectomy, roentgenograms (Fig. 4 C and D) revealed complete disappearance of the metastatic areas. The patient has been seen repeatedly since that time. There has been no recurrence of the osseous metastases and he is clinically well, except for occasional attacks of cystitis, eleven years after the diagnosis was established and thirty-four months after orchiectomy.

Of the 29 patients with osseous metastases, 10 failed to return after their original visit to the hospital. The average duration of follow-up for the 19 who returned for check-up and further treatment was 14.2 months. The longest was 48 months.

Table II is a summary of the clinical results obtained in the entire series of 67 cases. It is noted that approximately one-third of the patients improved, one-third were not followed, and one-third were unaffected so far as the course of their disease was concerned.

TABLE II: CLINICAL RESULTS OF TREATMENT OF PROSTATIC CARCINOMA

No follow-up	26
Improved	24
Dead (includes cases which improved temporarily)	6
Temporary improvement only	5
Worse	4
No change	4

SUMMARY

During a four-year period, 1942–45 inclusive, 67 patients with carcinoma of the prostate gland received estrogenic therapy. Twenty-nine of these patients had roentgenographic evidence of osseous metastases. Nineteen of the latter were followed over a period averaging 14.2 months. Unusual changes were observed in the osseous metastases, unlike those noted prior to estrogenic therapy. The characteristics of these alterations in the roentgenographic appearance of the osseous metastases have been described.

CONCLUSION

The radiologist in interpreting roentgenograms which demonstrate osseous metastases from carcinoma of the prostate should be familiar with the alterations in the bone lesions produced by estrogenic therapy.

Hitchcock Clinic
Hanover, N. H.

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SUMARIO

Efectos de la Estrogenoterapia sobre las Metástasis Oseas del Carcinoma Prostático

Durante un cuatrenio (1942–1946) 67 enfermos con carcinoma de la próstata fueron tratados con estrógeno. Veinte y nueve de esos enfermos tenían signos radiográficos de metástasis óseas, y 19 de éstos fueron observados durante un período subsiguiente que promedió 14.2 meses. En las metástasis notáronse alteraciones peculiares y distintas de las observadas antes de la estrogenoterapia.

En 5 casos las metástasis se volvieron más espesas y más discretas; en 2 hubo mejoría bien definida según reveló la disminución de la cantidad de hueso invadido, aunque no se modificó la configuración primitiva de la zona metastática. En 1 caso las metástasis prácticamente desaparecieron, pero fueron seguidas de extensas metástasis osteoblásticas de un tipo distinto. En 2 casos la desaparición de las metástasis fué completa.

Al interpretar roentgenogramas que revelan metástasis óseas de un carcinoma prostático, el radiólogo debe estar familiarizado con las alteraciones que produce la estrogenoterapia en las lesiones óseas.

Irradiation of Experimental Cerebral Tumours[1]

I. Experimental Production of Brain Tumours in Mice

KATHARINE TANSLEY, D.Sc.[2]

II. Some Observations on the Effect of X-Radiation on Experimental Gliomata in Mice

KATHARINE TANSLEY, D.Sc., and C. W. WILSON, M.Sc., PhD., F. Inst. P.[3]

THE RESULTS OF treatment of cerebral tumours by radiotherapy are generally admitted to be very unsatisfactory, although recently Peirce, Cone, Elvidge, and Tye (14) report rather more hopeful results. We have little knowledge of what types of cerebral tumour, if any, are suitable for radiotherapy (Bailey, 4; Bailey, Sosman, and Van Dessel, 5; Alpers and Pancoast, 1; Tarlov, 21). There is a good deal of evidence, also, that doses of x-rays or gamma rays likely to be effective in destroying a tumour have a destructive effect on brain tissue (Fischer and Holfelder, 8; Lyman, Kupalov, and Scholz, 11; Scholz, 17 and 18; Scholz and Hsü, 19; Markiewicz, 12; Wachowski and Chenault, 22), as well as on the skull (Camp and Moreton, 7).

It seemed, therefore, that it would be useful to investigate the effects of radiation on experimental cerebral tumours in animals.

PART I

The production of cerebral tumours by the introduction of carcinogens into the brain tissue of experimental animals is not an entirely simple matter; the results vary according to the species and strain of animal, carcinogenic substance and technique used. Most of the earlier attempts were unsuccessful. Askanazy (2) claimed to have obtained chondrosarcomata in the rabbit cerebellum as a result of introducing benzpyrene in olive oil or beef fat, but his results are questioned by Zimmerman and Arnold (28), while Bertrand and Gruner (6) found no true gliogenous neoplasia after injecting benzpyrene in lanolin, paraffin oil, or vaseline into the brains of rabbits. Weil (23), working on rats, appears to have been the first to obtain undeniable gliomata. He used crystalline dibenzanthracene in cholesterol, as well as styryl 430 in saline; with the former he obtained one invasive tumour among many failures, but with the latter he was usually able to induce tumours resembling human glioblastomata or meningiomata depending on the site of origin. Seligman and Shear (20) failed to produce gliomata in rats, mice, cats, or guinea-pigs by brain injections of methylcholanthrene in various media, but succeeded with mice when the carcinogen was introduced in the form of pellets, a result which was confirmed by Peers (13) who, however, got negative results in rats and rabbits when he used benzpyrene either in the solid form or dissolved in various media. Zimmerman and Arnold (3, 25–29), in an extensive investigation, have produced sarcomata and gliomata of various types in the brains of some pure strains of mice by the use of methylcholanthrene, benzpyrene, and dibenzanthracene pellets. These tumours could be preserved through several generations of host animals by grafting them under the skin of the back, as well as into the anterior chamber of the eye (Freeman and Zimmerman, 9). Later Russell (16) obtained cerebral tumours in rats by the use of pellets composed of a mixture of cholesterol and methylcholanthrene, and Lopez (10) produced a cerebral glioma by feeding a rat with 2-acetyl-aminofluorene.

In the present investigation, attempts to

[1] Accepted for publication in June 1946.

[2] Sir Halley Stewart Fellow, Strangeways Research Laboratory, Cambridge, England. Now at the Physiology Department, Birmingham University.

[3] Physics Department, Westminster Hospital, London, England.

produce cerebral tumours in mice by the introduction of benzpyrene powder resulted in two sarcomata in a total of 131 animals; benzpyrene pellets made according to the method described by Zimmerman and Arnold (28) produced no tumours in 13 animals, and methylcholanthrene pellets have, at the time of writing (339 days after the implantation) produced one sarcoma among 31 animals. The introduction of methylcholanthrene powder has been much more successful, 24 sarcomata and 10 gliomata having been obtained in 77 animals. The present paper deals only with the experiments in which methylcholanthrene powder was used.

Owing to experimental difficulties, which will be described later, only one glioma was preserved by transplantation, but this has now been transmitted to 103 mice, 49 of which have been subjected to x-ray irradiation.

Method: Two strains of mice were used for the production of the induced tumours, the albino Ni strain, originally obtained from the National Institute for Medical Research, London, and a mixed pigmented stock of uncertain origin bred in the laboratory. For the subsequent grafting of the tumours the Ni strain only was used.

The operation of implanting the carcinogen was performed when the mice were two days old. Under ether anaesthesia a central incision from the level of the shoulders to that of the eyes was made in the skin. A semicircular flap was then cut in the skull with a small scalpel, and the methylcholanthrene powder (Hoffmann-LaRoche) was injected into the left hemisphere. For this the point of a wide gauge hypodermic needle was cut off and a small amount of the powdered methylcholanthrene pressed into the tip; a special metal plunger was used to push the methylcholanthrene deep into the brain tissue after the needle had been inserted into the hemisphere. The skull flap was then allowed to drop back into position and the edges of the skin were fastened together with 2 per cent celloidin solution. The animals were allowed to recover from the anaesthetic in an incubator at 37° C. before being returned to their mothers. Aseptic precautions were, as far as possible, observed throughout the operation.

The glioma used for grafting was obtained from an animal 397 days after the implantation of methylcholanthrene. The mouse was killed with chloroform and the brain was removed and cut open. Part of the left hemisphere, which showed many small haemorrhages, was cut out and placed in sterile saline, while the rest of the brain was fixed in Zenker's solution. The brain tissue to be grafted was then cut into small pieces and these were implanted in the brains of a litter of 2-day-old mice. The method was similar to that used for the original implantation of methylcholanthrene except that a piece of tissue was cut out of the left hemisphere and the fragment of tumour placed in the hole so formed.

The grafted tumour fragments produced marked lumps on the heads of the host mice, and these were measured daily with calipers as soon as they were big enough. As far as possible, three measurements were taken: anteroposterior, lateral, and the height above the top of the head. A rough estimate of the volume of the tumour could be made from these measurements. In each litter at least one of the tumours was allowed to grow untreated as a control, another was used for further grafting, while the rest were subjected to x-radiation as soon as possible after the lump was first noticed.

A certain number of the animals died unexpectedly and the tumours and brains of these were fixed in formalin. The rest were killed when it was expected that they could not survive until the next day. The brains of these were fixed in Zenker's solution. Serial paraffin sections were cut at 10μ and were stained in haematoxylin and eosin, by Feulgen's method, by a modification of the azan method, and by Mallory's phosphotungstic acid haematoxylin. Some specimens were stained by Wilder's method for reticulin fibres and by Alzheimer and Mann's method for glial fibres.

Results: Thirty-five mice from the laboratory stock and 42 of the Ni strain, making 77 animals in all, were used for implantations of methylcholanthrene powder. In the laboratory stock 13 sarcomata and 6 gliomata developed. Among the 24 sarcomata there were 4 rhabdomyosarcomata. These were apparently due to some of the methylcholanthrene working back through the skull before healing of the bone had taken place.

There were some quite definite macroscopic differences between the induced sarcomata and gliomata which, with some

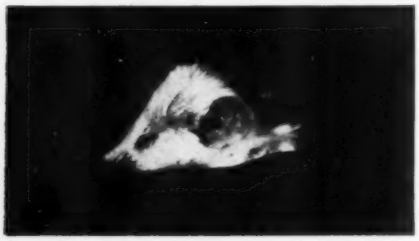


Fig. 1. Mouse with transplanted tumour.

experience, made it possible to be fairly sure to which group a given tumour belonged even before it had been examined histologically. All the sarcomata, including the rhabdomyosarcomata, penetrated the skull at the site of the operation and produced a definite lump on the top of the head, as well as some destruction of the brain. The gliomata remained within the skull, producing at most a generalised swelling of the head. A sarcoma was usually enclosed within a fibrous capsule; a glioma spread throughout the brain so that it was impossible to tell macroscopically where the tumour tissue ended and healthy brain tissue began. A characteristic feature of all the gliomata, whether induced or grafted, was the presence of numerous haemorrhages within the tumour.

Since an induced glioma produced no very obvious external signs, it was often extremely difficult to recognise its presence while the animal was alive. Usually an apparently healthy animal was found dead

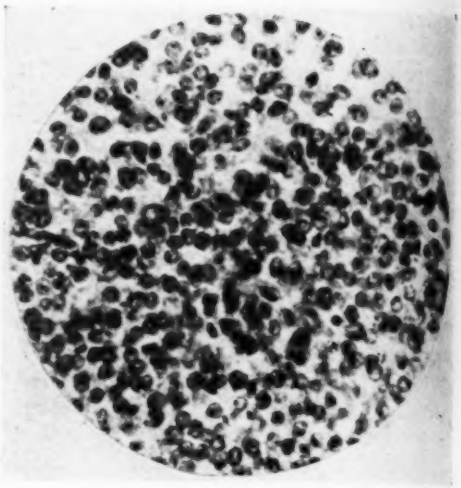


Fig. 2. Section through a transplanted glioma (mouse 100c). Some normal brain tissue can be seen at the top of the photograph. Note mitoses in the tumour. Zenker; haematoxylin and eosin. ×410.

in its cage, and an examination of its brain revealed the presence of the tumour, too late to make grafting possible. As soon as this difficulty was realised, all the remaining animals were killed, about a year after the implantation of the methylcholanthrene. Unfortunately, only one of these 14 animals was found to be bearing a tumour, but since this appeared to be a glioma, it was grafted into the brains of a fresh litter of Ni mice and is the parent of all the grafted tumours with which the present investigation is concerned.

Each type of tumour obtained, fibrosarcoma, rhabdomyosarcoma, and glioma, bred true to graft. Several passages (a maximum of 7 in the case of the glioma) made no difference in the histological appearance of the tumour tissue. Since this paper is mainly concerned with the maintenance and reactions of gliomata, the histology of the sarcomata will not be considered here.

Grafts of glioma tissue were successful in every animal that survived the operation (85). The average interval elapsing between the operation and the first appearance of a lump or swelling was twenty-three days, the longest period sixty-five

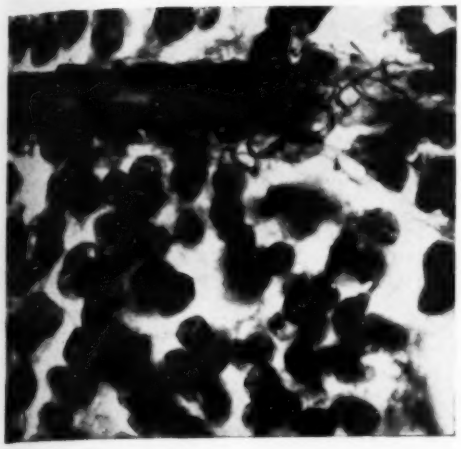


Fig. 3. Section through a transplanted glioma (mouse 99A), stained by Wilder's method for reticulin. Note the absence of fibres except around the capillary. Compare with Figs. 4 and 5. Zenker; Wilder. ×825.

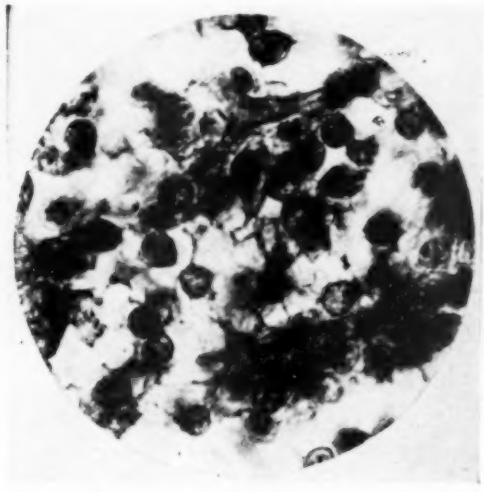


Fig. 4. Another part of the tumour shown in Fig. 3 (mouse 99A), stained by Alzheimer and Mann's method for glial fibres. Note the network of fibres connecting the tumour cells. Compare with Figs. 3 and 5. Zenker; Alzheimer and Mann. ×825.

and the shortest ten days. The average time for an induced glioma was 293 days, the longest and shortest periods being 397 and 170 days, respectively.

The grafted gliomata, probably because they grew so quickly, differed from those that were induced in that they usually broke through the skull at the site of the operation, producing an easily recognisable lump on the head (Fig. 1).

Figure 2 shows a section of one of the grafted gliomata. It is mainly composed of small cells with star-shaped cytoplasm and is relatively undifferentiated. In general appearance it is like the cerebral tumour described by Lopez in a rat and said by him to resemble a human glioblastoma isomorphe. A fair number of mitoses are present. Staining by Wilder's and the azan technique showed no reticulin fibres (Fig. 3) except along the vessels. On the other hand, Alzheimer and Mann's method for glial fibres revealed a fine network of blue-grey fibres connecting the tumour cells (Fig. 4). In this respect the tumour showed a marked contrast to the sarcomata, in which many reticulin and collagen fibres, all running roughly parallel to one another, were easily demonstrated (Fig. 5). These staining reactions provide convincing

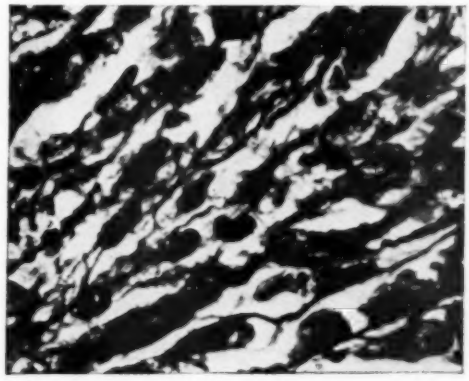


Fig. 5. Section through a transplanted sarcoma (mouse 42c) stained by Wilder's method for reticulin. Note the numerous fibres, all running roughly parallel, connecting the tumour cells. Compare with Figs. 3 and 4. Zenker; Wilder. ×825.

evidence that the tumour really is a glioma.

The tumour cells can be seen invading the brain particularly through the perivascular and ventricular spaces; they also penetrate the actual brain tissue and are often grouped round the ganglion cells. There is no reaction on the part of the normal brain tissue and no round-cell infiltration.

PART II

Method: In order to ensure that the mice did not move during the exposure to radiation they were lightly anaesthetised with nembutal. An intraperitoneal injection of 0.01–0.05 gr. nembutal in saline (the amount varying with the weight and response of the animal) was given immediately before the exposure. The usual dose was 0.02 gr. for a mouse of 15–20 gm.

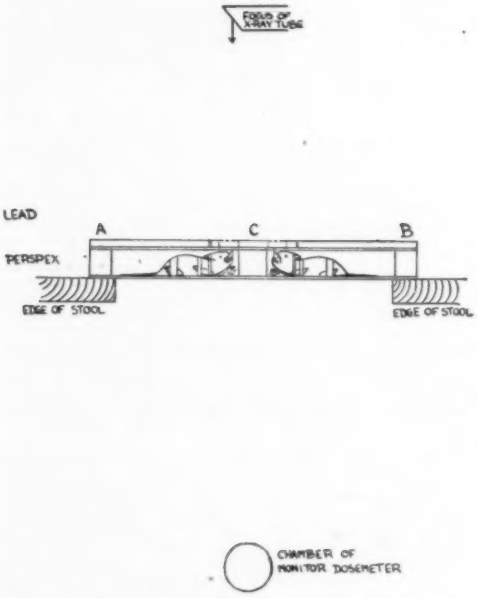


Fig. 6. Complete arrangement for irradiation, side view.

The x-radiation used was generated at 180 kv. (Villard circuit) and filtered by 0.5 mm. Cu + 1.0 mm. Al; the half-value layer of the radiation was 0.95 mm. Cu, corresponding to an effective wave length of about 0.16 Å. The distance from tube focus to the centre of the mouse brains was approximately 25 cm.; the mean dose rate was 154 r/min. in all the experiments. Up to 4 animals could be irradiated at once.

The apparatus in which the animals were exposed (Fig. 6) was designed as a complete box to prevent the mice escaping into the hospital if they recovered from the anaesthetic during the irradiation. The box was mounted 70 cm. above the floor

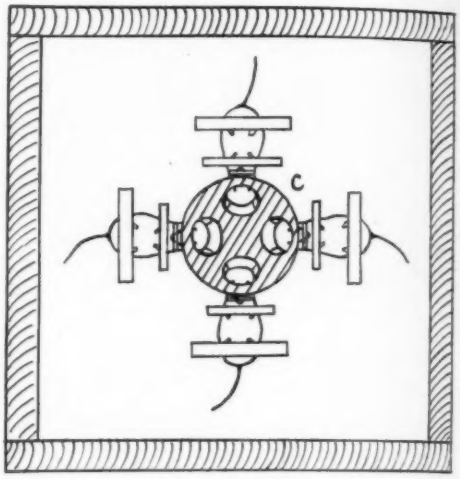
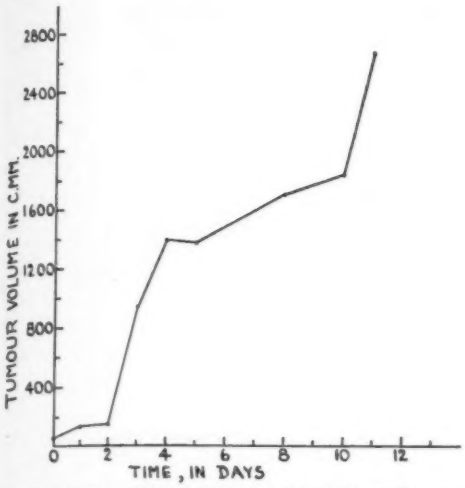


Fig. 7. Arrangement of four mice underneath the windows in the lead cover C before the lid AB is placed in position.

between two stools. Experiments with normal mice had shown that if the animals were to survive the irradiation by more than about ten days, it was essential to protect the upper respiratory and alimentary tracts; severe radiation reactions had also been produced by exposure of the ears and eyes. For these reasons the apparatus and method of mounting the animals inside it were designed to expose as much of the brain and as little other tissue as possible.

The upper lid of the box ACB (Fig. 6) was made in two parts, a circular cover, C (Fig. 7) fitting into a hole in the centre of the lid proper. The lead sheet of the cover C contained 4 elliptical windows through which the x-rays could reach the brains of the animals beneath (Fig. 7).

Before the exposure, the cover C was placed over the centre of the box, where it was held in position by a wooden base. The anaesthetised mice were adjusted beneath the windows with their heads bent as far forward as possible; a strip of adhesive tape fastening the nose to the neck maintained this position (Fig. 6). The remainder of the lid AB was then put in place so that, except for the windows, the animals were completely screened by a sheet of lead 6 mm. thick. The x-ray



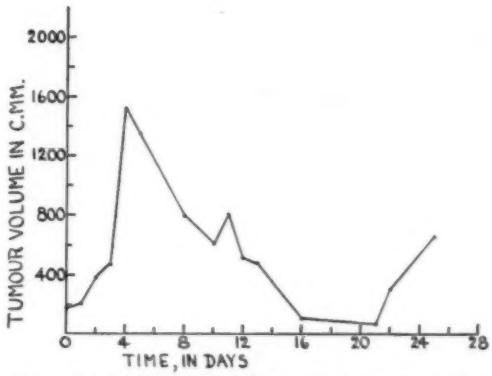


Fig. 8 (left). Growth of transplanted glioma in mouse 111G. Irradiation with 3,247 r has had no very marked effect on the rate of growth. Compare with Fig. 9. Abscissae: Time in days. Ordinates: Volume of tumour in cubic millimeters.

Fig. 9 (right). Growth of transplanted glioma in mouse 111F. This animal was a litter mate of 111G. Both had a piece of the same tumour grafted into the brain on the same day; each first showed a measurable lump after eighteen days; each was exposed to a dose of 3,247 r four days later. Note the decrease in size of the tumour after irradiation. Abscissae: Time in days. Ordinates: Volume of tumour in cubic millimeters.

tube was adjusted and the exposure given. The animals were sometimes restless in spite of the anaesthetic, so that it was necessary to fix the limbs and body to the base of the box with adhesive tape to prevent their moving during the exposure.

The dose rate was determined with the apparatus set up as in Figure 6 but without the cover C in place, so that the beam of radiation could reach the ionization chamber of a Siemens dosage-rate meter mounted at a known distance below the centre of the box. The dose rate at the position occupied by the mice was measured by means of small condenser ionization chambers (24); the dose rate on the Siemens dosemeter was recorded at the same time. The latter thus served as a monitor for the dose delivered to the animals, and for each set of irradiations the conditions were checked and, if necessary, adjusted by means of the monitoring dosemeter. The dose delivered by this technique is not perfectly uniform throughout the part of the brain exposed, but, having regard to the average dimensions of the mouse brain, its distance from the focus and the quality of the radiation, it is not likely that the doses received by any given part of a brain or tumour varied by more than about 10 per cent from the average values.

Results: Thirty-nine of the 85 grafted tumours were irradiated; of these, 12 received a dose of 1,623 r, 10 a dose of 2,434 r, 2 a dose of 2,850 r, and 15 a dose of 3,247 r.

The effect of irradiation on the growth of the tumours was very variable. In some individuals a dose of as much as 3,247 r seemed to have no effect whatever on the rate at which the size of the tumour increased (Fig. 8) while in others, sometimes litter mates, the tumour decreased in size and might even disappear altogether for a time (Fig. 9). However, in no case was the tumour entirely destroyed; even in a mouse where the lump did not reappear and the postmortem examination showed no swelling, histologic examination revealed the presence of tumour tissue in the brain, although the whole of the left and much of the right hemisphere had completely disappeared, leaving a cavity full of fluid in their place.

In general, the higher doses were more effective in arresting the tumour growth.

With a dose of 1,623 r the growth of 2 out of 12 tumours irradiated was temporarily arrested; with 2,434 r the figure was 5 out of 10; with 3,247 r, 6 out of 13. The survival times after the different doses are given in Table I.

TABLE I: SURVIVAL PERIODS AFTER IRRADIATION

Dose (r)	No. mice Irradiated	Average Time of Survival After Exposure (Days)	Shortest Survival Time (Days)	Longest Survival Time (Days)
1,623	14	8.1	0	30
2,434	9	13.8	0	21
2,850	2	9.5	6	13
3,247	9	9.7	7	18
3,247 (enlarged aperture)	5	21.6	0	54

Eight mice were killed or died within forty-eight hours of the exposure to x-rays, and histological examination showed that mitosis had entirely disappeared from the tumour tissue. Later, however, it reappeared.

Brains which were examined from seven to eighteen days after irradiation showed widespread necrosis and diffuse bleeding in the tumour tissue. Five animals which died suddenly either during or within a few hours of the exposure all had profuse haemorrhages from the tumour tissue.

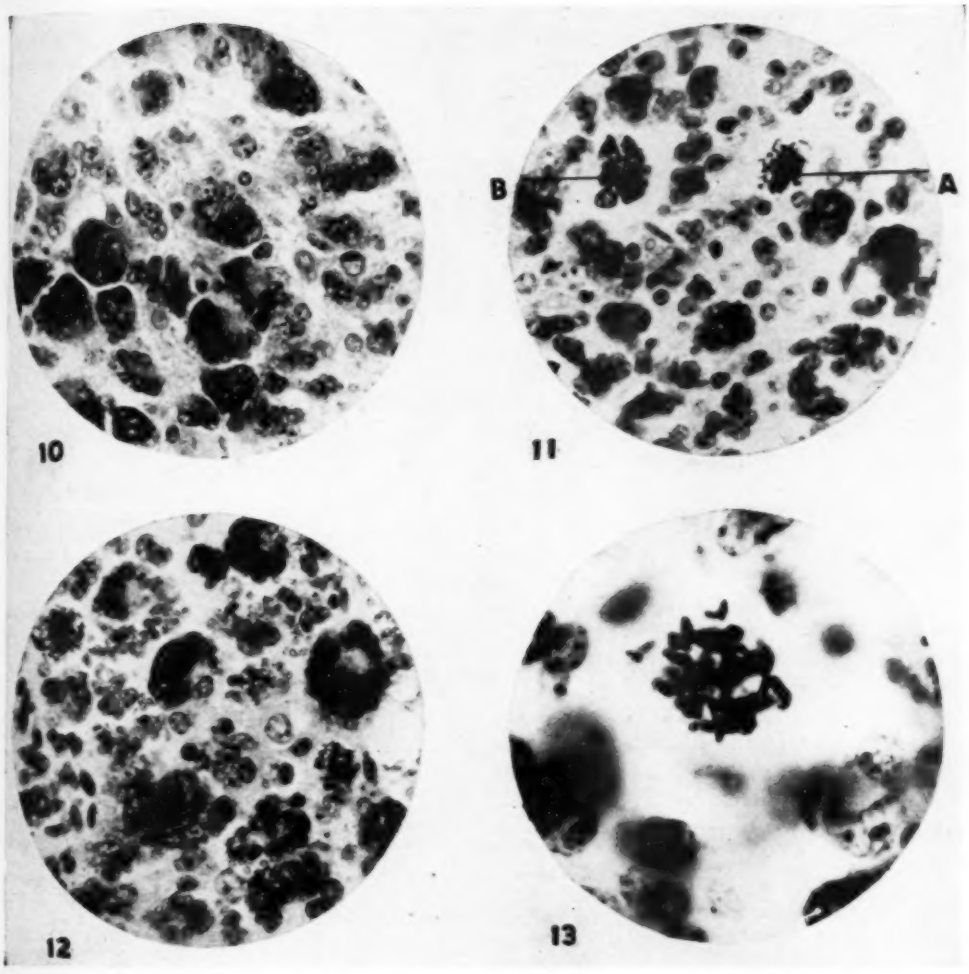
Of the 23 irradiated tumours examined histologically more than seven days after the exposure, 18 had areas full of multinucleate symplasms (Fig. 10). Often these areas also contained giant cells, a number of which showed abnormal mitosis (Figs. 11–13). The appearance of multinucleate and giant cells was more widespread and the cells were bigger the longer the animal survived irradiation.

DISCUSSION

As mentioned above, several animals died suddenly and unexpectedly either during the exposure to radiation or soon afterward. In all these cases postmortem examination revealed fresh and extensive haemorrhage from the tumour tissue. This finding emphasises the warning sounded by several writers with clinical experience (5) of the danger of cerebral haemorrhage when certain types of human glioma are given radiotherapy.

The failure to produce any complete cures, although the growth of the tumour was arrested in a fair proportion of cases, is also in line with modern experience of human material. Peirce, Cone, Elvidge, and Tye (14) report considerable temporary benefit from x-radiation, but the symptoms recurred, with fatal results in most of their cases and, although in favour of irradiation where surgical removal is not possible, these authors do not claim to do more than add a few extra years to their patients' lives. Peirce and his fellow-workers usually use higher doses than we considered desirable for mice; they recommend 10,000–15,000 r in daily 100 r doses. It is true that with the mouse tumours the only lump which did not reappear was given a dose of 3,247 r, but the *average* result (as measured either by the survival time or by the number of animals showing regression of the lump) with 2,434 r was at least as good as with 3,247 r.

If the failure to cure the tumour is attributable to the irradiation technique, and not to the reaction of the tumour tissue, then it is due to the difficulty of reaching all parts of the mouse brain without destroying the eyes, ears, or upper respiratory and alimentary tracts, rather than to inadequate dosage. In those cases in which the tumour's first response to irradiation was a decrease in size it was a common experience to find that swelling did not recur on the site of the old lump but laterally just above and around the ears. Subsequent histologic examination revealed that active tumour tissue had spread down between the brain and skull as well as through the ventricles, but that it had disappeared around the site of implantation. This finding suggested that an increase of the area irradiated might give better results, and consequently the aperture in the lead screen was enlarged laterally in spite of the increased risk of including the ears (with the likelihood of producing aural



Figs. 10–13. Sections through a transplanted glioma (mouse 117A). The animal was killed *in extremis* twelve days after irradiation with 3,247 r.

Fig. 10. Note the multinucleate symplasms. Zenker; haematoxylin and eosin. ×375.

Fig. 11. Note one giant cell in metaphase (A) and another showing the end-phases of a multipolar division (B). Zenker; Feulgen. ×375.

Fig. 12. Showing two giant cells in mitosis. Zenker; Feulgen. ×375.

Fig. 13. Showing a dividing giant cell. Zenker; Feulgen. ×c.1100.

abscesses) in the irradiated area. By this method we increased the average survival time after exposure to 3,247 r from 9.7 to 21.6 days.

A graft was not considered a certain success until a recognisable lump or swelling was observed, and none of the animals was irradiated earlier. However, histologic examination revealed that even at this early stage there was already considerable invasion of the ventricular spaces by tumour cells, and it is possible that the recurrences were due to malignant foci located in parts of the brain beyond reach of the x-ray beam, set up by spreading of tumour tissue through the ventricles. On the other hand, it must be emphasised that with 3,247 r and an enlarged aperture the growth of some of the tumours did not appear to be at all affected by x-radiation,

so that even if we could be sure of reaching every tumour cell with an adequate dose we should still expect a fair proportion of failures.

The multinucleate symplasms and giant cells, the latter often showing abnormal mitosis, were never seen in the unirradiated tumours, but occurred in some parts of most of the tumours from animals which survived irradiation by more than 7 days. They seemed to be rather more common in those tumours which responded to radiation by a decrease in size. In most cases the longer the interval between irradiation and death, the bigger the groups of nuclei. They were never seen in an actively growing part of an irradiated tumour and it seems safe to assume that their presence was a result of the irradiation.

It is already known that two common effects of irradiation are increase in cell size and abnormal mitosis, often resulting in the inability to produce complete daughter cells, with the consequent production of multinucleate cells (Politzer, 15). Therefore, it seems that the most probable explanation of the multinucleate symplasms observed in these tumours is that they are the result of repeated endomitosis of the giant cells in consequence of the irradiation.

SUMMARY

1. Cerebral tumours, both sarcomata and gliomata, were produced in mice by the implantation of methylcholanthrene powder at an early age.

2. The tumours were preserved by grafting pieces of their tissue into the brains of other young mice.

3. A number of grafted tumours from a glioma were treated with x-rays.

4. There was much individual variation in the reaction of the grafted tumours to radiation; some appeared to be unaffected while the growth of others was temporarily arrested. There were no cures.

5. The histologic changes produced in this tumour as a result of irradiation are described.

ACKNOWLEDGMENTS: We owe an especial debt of gratitude to Dr. A. Glucksmann, without whose encouragement and help, especially in the treatment and interpretation of the histologic material, this investigation would probably never have been completed.

We also wish to thank Mr. Lenney of the Strangeways Laboratory for making the photomicrographs and Mr. N. H. Pierce of the Physics Department, Westminster Hospital, for his assistance with the irradiations.

We thank Dr. F. M. Allchin of Westminster Hospital for so readily giving us permission to use an x-ray set in his department for the experiments, and one of us (C. W. W.) acknowledges the financial assistance given his department by the British Empire Cancer Campaign.

The Medical School
Birmingham, England

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SUMARIO

La Irradiación de los Encefalomas Experimentales. I. Producción Experimental de Tumores Cerebrales en Ratones. II. Algunas Observaciones Relativas al Efecto de la Radiación X sobre los Gliomas Experimentales en Ratones

Por medio del implante de polvo de metilcolantreno a una edad temprana, produjéronse en ratones tumores cerebrales, tanto sarcomas como gliomas. Los tumores fueron conservados mediante injertos de trozos de tejido en los cerebros de otros ratones jóvenes.

Varios tumores injertados de un glioma fueron tratados con los rayos X. Hubo mucha variación individual en la reacción de los tumores injertados a la radiación: algunos aparentemente no se afectaron, en tanto que en otros se estacionó temporalmente la proliferación. No hubo curaciones. Descríbense las alteraciones histológicas producidas en estos tumores por la irradiación.

Osteochondritis Dissecans of the Ankle

With Reports of Four Proved Cases[1]

A/SURGEON-COMDR. C. E. VAUGHAN, R.C.N. (R)[2] and SURGEON-LIEUT. J. G. STAPLETON, R.C.N. (R)[3]

THE PATHOLOGICAL condition known as osteochondritis dissecans has a surprisingly long history in medical literature. Various writers have pointed out that Alexander Munro (18) recognized the condition in 1738. It was not until 1887, however, that König (13) gave the first accurate description of the anatomy and pathology of the condition. Both men based their reports on surgical operations and dissection of cadavers. With the widespread use of diagnostic roentgenology the diagnosis is no longer a rarity.

The name "osteochondritis dissecans" was suggested by König (14) in 1905. Although, as Burr (4) points out, it is not entirely appropriate, in that it suggests an inflammatory condition, it has become hallowed by usage and will no doubt remain along with many other terms which the march of medical progress has rendered inaccurate.

Osteochondritis dissecans is an aseptic necrosis of subchondral bone and the overlying cartilage. Usually a small area of bone adjacent to the articulating surface is affected. When it becomes necrotic, the overlying cartilage is devitalized, and frequently the entire fragment separates out and forms an intra-articular loose body. Recurrent pain, effusion, weakness, and the development of osteoarthritic changes constitute the usual sequence of events if the condition is untreated. It seems likely that the lesion properly belongs, as Phemister (20) has pointed out, in the group of aseptic necrosing lesions of bone, which includes necrosis of the fractured femoral head, Kienböck's disease, Legg-Perthes' disease Köhler's, Freiberg's, Osgood-Schlatter's, and others.

The early writers all referred to involvement of the knee joint, but many reports have since appeared describing the lesion in other areas, including the femoral head, the head of the humerus, the capitellum of the humerus, the ankle, the metacarpophalangeal joints, and recently the supratrochlear septum of the humerus (Crysler and Morton, 8). It appears that the condition is rather uncommon in the ankle, as few reports are to be found in the literature, and only a very occasional one in English. The earliest accounts of ankle involvement appeared in the German literature in 1927 (Breitländer, 2; Harms, 10). Subsequently, a few additional cases were published, the majority of them in foreign-language journals until, at the time of Mensor and Melody's (17) excellent review in 1941, a total of 19 cases had been recorded. Their case brought the total up to 20. Four further papers on the subject have appeared in the past five years, but unfortunately only two of these are available to us. This paper is a presentation of four additional proved cases. Three of these were seen in the Atlantic Command of the Royal Canadian Navy and one at the McGregor Clinic, Hamilton, Ontario.

The etiology of the condition has been the subject of considerable discussion, which has been well summarized by Conway (7). The main theories of origin may be divided into traumatic and non-traumatic. The latter include embolic, bacterial, and constitutional theories. The traumatic theory seems best supported by the evidence, and we feel that trauma is the major factor in these cases. It is possible, however, that some patients at least have an underlying predisposition to the condition, since it is not unusual for more than

[1] Accepted for publication in September 1946.
[2] Senior Radiologist, Atlantic Command, Royal Canadian Navy.
[3] Radiologist, Royal Canadian Naval Hospital, Sydney, N. S., Canada.

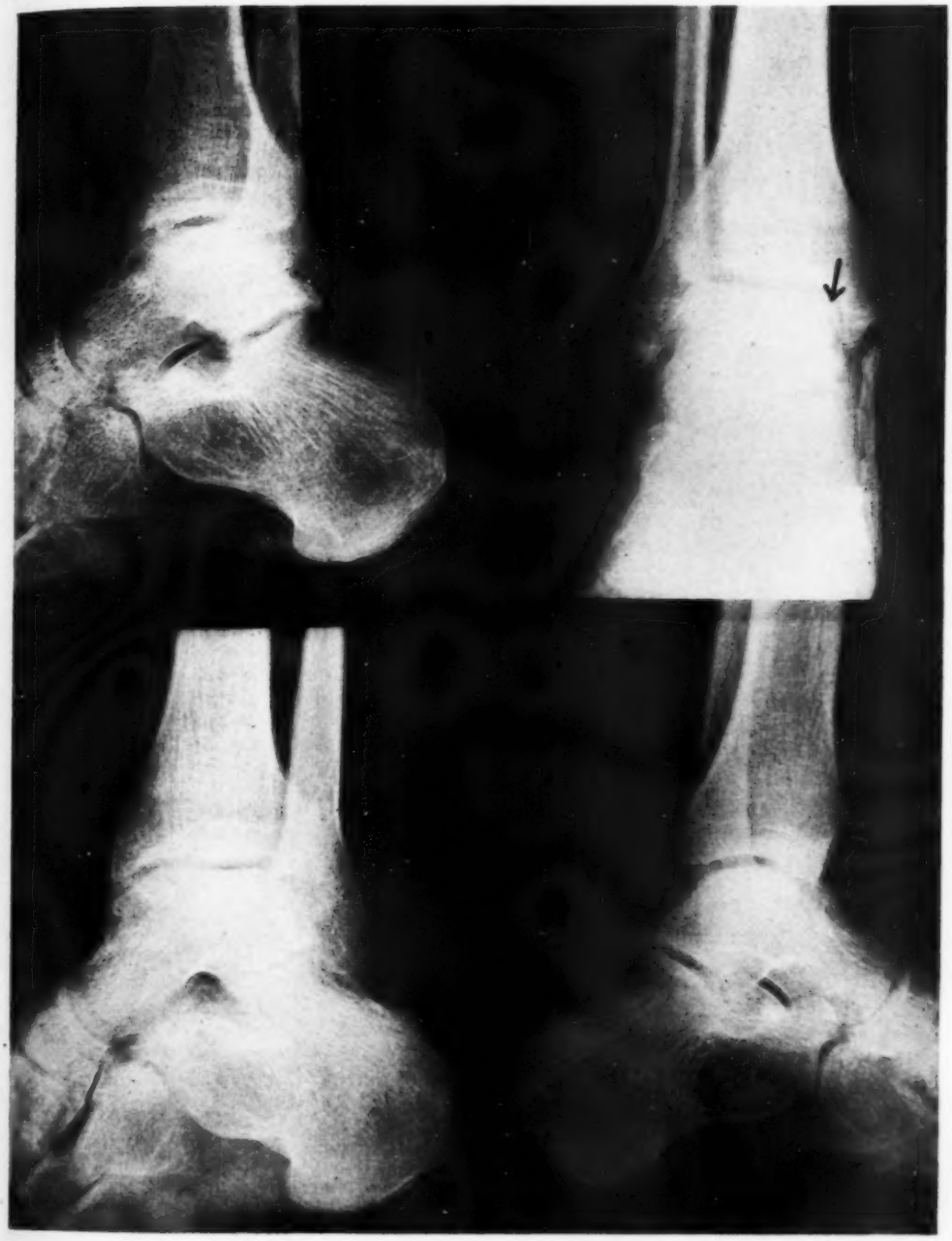

Fig. 1. Case 1: Spicule of bone off medial aspect of talus. Unfortunately preoperative films were un available in this case.

one joint to be affected, often without any definite history of injury. Perhaps there may be some metabolic or constitutional predisposing condition such as is found in many of those with slipped epiphyses in adolescence.

All writers agree that the treatment of choice is surgery, since there is no tendency for revitalization of the fragment, even in those cases where complete separation and loose-body formation have not occurred. Early surgical excision will forestall the development of the traumatic synovitis and arthritic changes which cause permanent disability.

DIAGNOSIS

Patients with ankle injuries, especially tearing of the collateral ligaments and subluxation without fracture, should be watched for the development of subsequent osteochondritis dissecans of the talus. This affects the upper portion of the articular surface, presumably due to injury by impingement against the internal surface of the malleoli during subluxation. Mensor and Melody have recommended the use of tomography as a diagnostic aid. We have not used this method. Our routine study of the ankle includes four views, and we have found that in most cases the lesion of osteochondritis dissecans is best seen in one of the oblique views. The characteristic roentgen findings are similar to those found in other joints. A small button-like fragment of devitalized bone is visualized lying in a depression at the upper margin of the trochlea of the talus on either the medial or lateral side. Usually it is demarcated from the adjacent bone by a radiolucent line. In none of our cases had the condition progressed to the formation of a completely free intra-articular loose body, but this, no doubt, does take place. One ankle was affected in each of the cases here reported, but bilateral involvement is known to occur. Both ankles were affected in a patient seen by a local orthopedic surgeon while in military service in Italy (12). Only one side was causing symptoms at the time.

SUMMARIES OF CASE HISTORIES

CASE 1 (Fig. 1): A. C., male, age 55, reported on Aug. 6, 1941, complaining of pain in the right ankle, present for six to seven years. He said that the ankle was weak and frequently "turned over," that it had been sprained several times, and that when he "went over" on his ankle he had a very sharp pain in the joint followed by a persistent ache for the rest of the day. Pain and aching were sufficient to interfere with his work. Clinical examination suggested a recurrent subluxation. Treatment was conservative for about eight weeks, but no improvement occurred. On Oct. 4, 1941, an x-ray film showed a defect in the medial portion of the superior surface of the talus.

Diagnosis: Osteochondritis dissecans.

Operation: On Oct. 7, the joint was explored. "There was a circular piece of cartilage noted on the inner weight-bearing portion, which was loose and divided into two pieces. These were lifted out, and by curetting, a cavity 1/4 × 1/4 inch was cleaned. A culture was taken. A cast was applied."

Pathological Examination: No organisms were demonstrated by smear or culture. The pathologist reported osteochondritis dissecans.

Follow-Up: Progress was good and x-ray studies showed filling in of the defect until April 1942, when the patient complained of pain over the internal side of the joint on walking, and a small spicule of bone fractured off the medial margin of the talus was demonstrated roentgenographically (Fig. 1). This was removed by operation on April 7.

On May 23, 1942, x-rays showed that the bony spicule had been removed and that the original area of osteochondritis was filling in still further. The patient was followed until July 1942, when function was excellent and he returned to work. He was to be kept under observation by his plant nurse. He has not returned to the clinic.

CASE 2 (Fig. 2); H. B., male, age 22, reported to sick bay on June 30, 1944, stating that he had turned his ankle while attending a staff picnic on June 19. He complained of persistent swelling and pain. Physical examination showed moderate edema around tip of external malleolus and tenderness over anterior aspect of ankle joint. Radiographically a small piece of bone, approximately 1 cm. in diameter and 2 mm. in depth, was seen to be separated from the lateral portion of the superior surface of the talus. It was elevated about 1 mm. from its bed. No other abnormality was noted.

Opinion: Osteochondritis dissecans of talus.

Operation: On July 24, "an area of partially separated cartilage 1 cm. × 0.5 cm. was taken out with a curette, leaving a space appearing larger than the fragment."

Convalescence was complicated by a mild wound infection. The patient was discharged on Sept. 14, 1944, walking without distress.

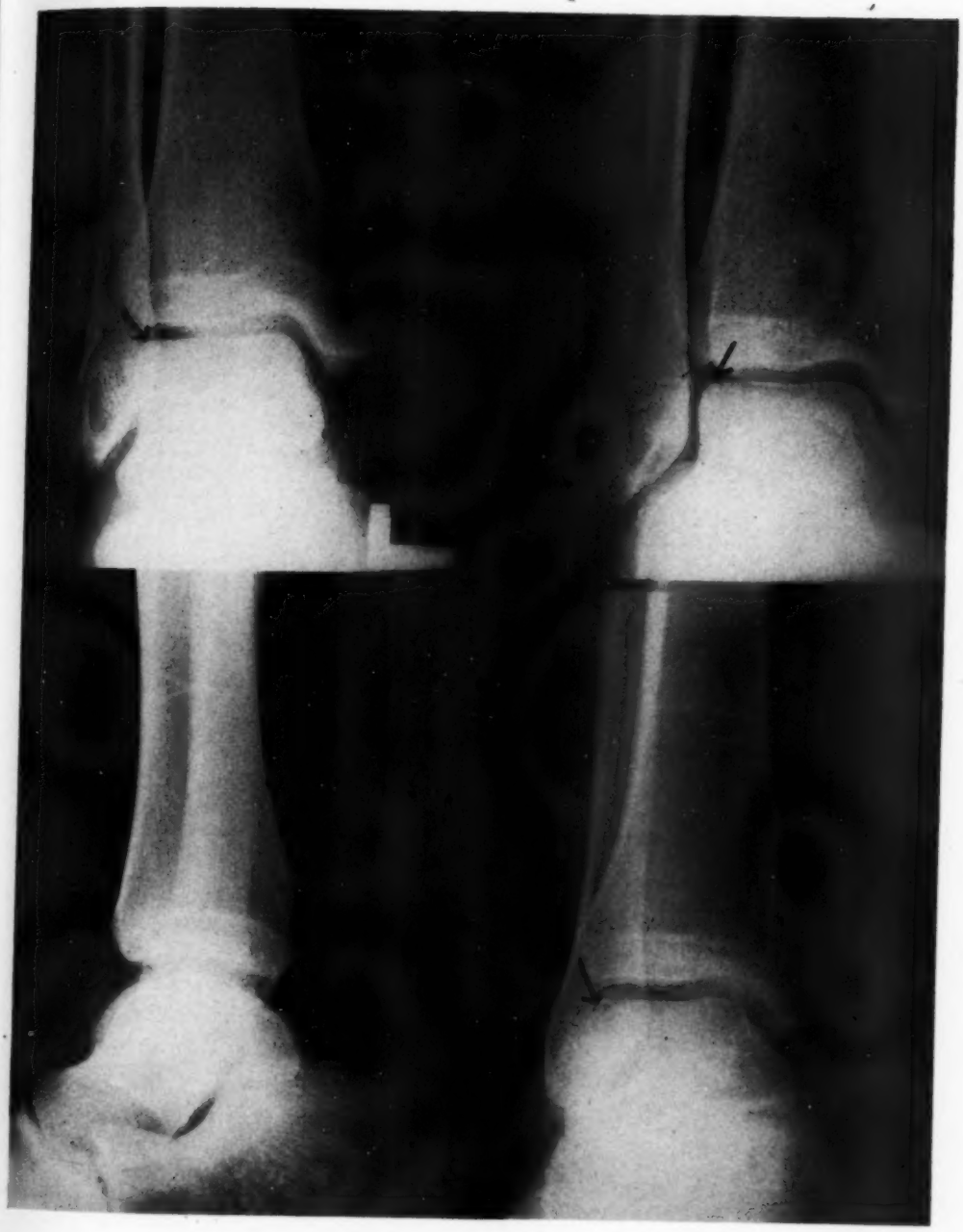

Fig. 2. Case 2: Ossicle visible on superolateral surface of talus.

CASE 3 (Fig. 3): V. F. R., male, age 19, reported to sick bay on Aug. 10, 1943, complaining of pain in the left ankle. He stated that for one and a half years he had had pain on the lateral side of the ankle on walking or playing strenuous games. The joint became painful and stiff on occasions and was hard to move. It had never been actually locked. The pain had become severe a few days before. Physical

Fig. 3. Case 3: Ossicle visible on upper medial surface of talus.

examination showed swelling of the ankle and tenderness one inch anterior to the tip of the external malleolus.

Films were made of the left ankle region in four positions. These showed an osteochondritis dissecans of the upper surface of the talus. A small fragment of bone 1/4 inch in each diameter lay on the extreme medial aspect of the upper articular sur-

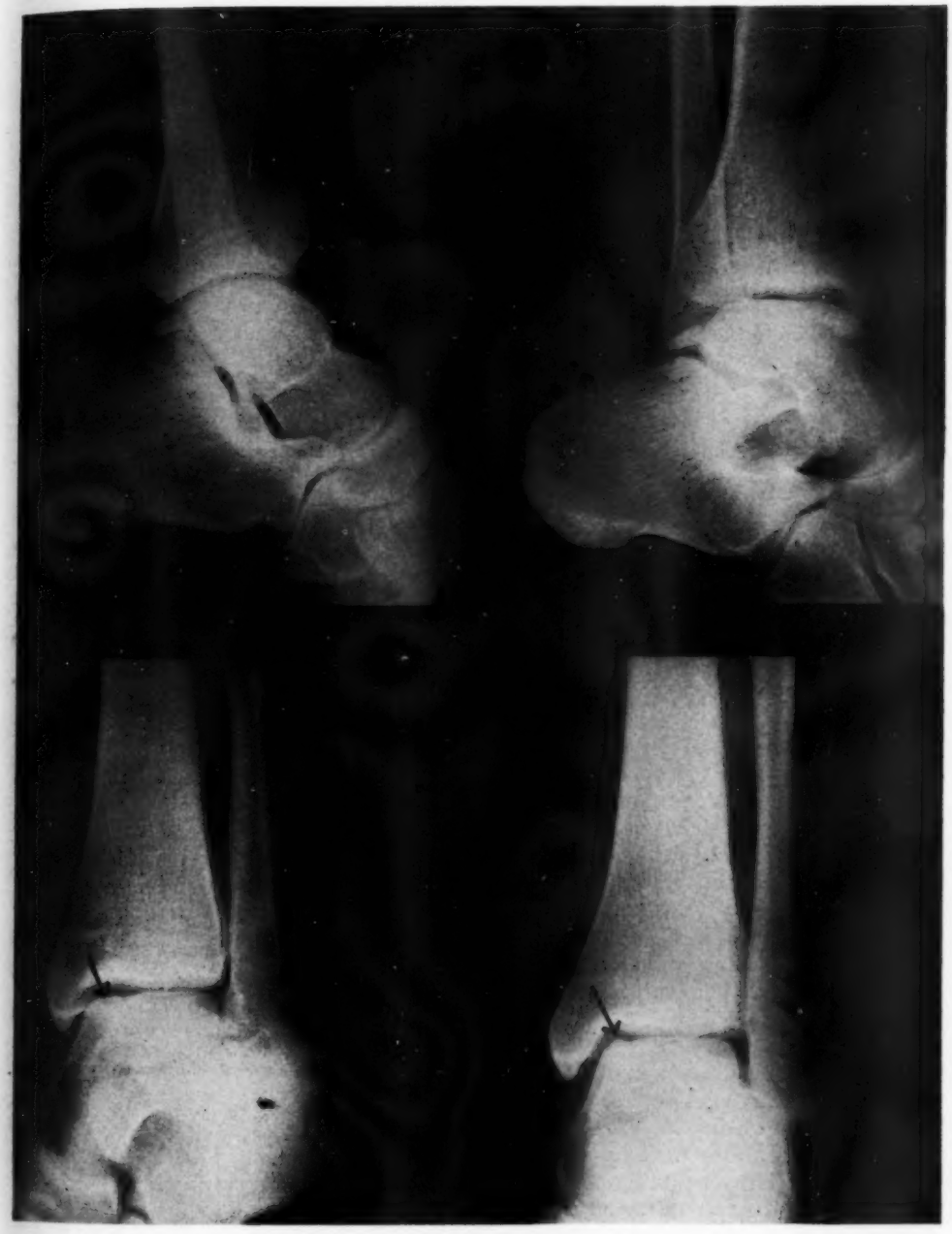

Fig. 4. Case 4: Ossicle separated from superomedial aspect of talus.

face of the talus. Films of the right ankle in four positions were negative.

Opinion: Osteochondritis dissecans of left ankle.

Operation: The report of the operation (Aug. 11, 1943) was as follows: "The fragment was moveable under intact cartilage. A piece of bone 1 cm. × 0.5 cm. was removed through divided cartilage, leaving a pit in the superomedial surface of the astragalus.

The base was covered with cancellous bone. Joint closed with firm dressing."

The patient was discharged to twenty-one days convalescent leave on Sept. 2, 1943.

CASE 4 (Fig. 4): M. C. B., female, age 26, reported to sick bay on Jan. 17, 1945, complaining of instability of the left ankle. In November 1944 she had first noticed that the ankle was unstable and appeared to "collapse," so that she tended to fall forward. In September 1944, she had undergone her initial training in the W.R.C.N.S., which had involved considerable marching. A distinct snapping sound could be heard on flexion and extension. There was slight tenderness on palpation over the anteromedial aspect of the joint. Continued pressure there prevented snapping. Crepitus was noted on flexion.

Roentgen examination showed a small fragment of bone separated from the superior articular surface of the talus on the medial side, and a diagnosis of osteochondritis dissecans was made.

Operation: At operation an "area of diseased cartilage at the extreme posteromedial aspect of the weight-bearing portion of the talus, 4 mm. × 2 mm. in size, was lifted off, and the underlying soft bone curretted, leaving a saucerized depression."

The patient was discharged to convalescent leave on Feb. 12, 1945, at which time she had been walking for several days without pain or discomfort. There was slight limitation of plantar and dorsi-flexion.

SUMMARY

1. Osteochondritis dissecans occurs in the ankle but is not common in that situation, only 20 cases being reported in the literature up to 1941. The complete text of several subsequent reports is not available to the authors at present.

2. Four proved cases of osteochondritis dissecans of the talus are here presented. The upper medial portion of the articular surface was involved in 3 cases, and the upper lateral margin in 1.

3. With one exception, the patients were males. The ages ranged from 19 to 55, the mean age being 30 years.

4. The duration of symptoms was from one week to approximately six or seven years. There was a suggestive history of antecedent trauma in 3 cases.

5. The radiologic findings were very similar to those in osteochondritis dissecans of the knee. A small button-shaped fragment of bone was observed subjacent to the articular cartilage on the superior surface of the talus. This was surrounded by a narrow radiolucent zone. The bony fragment was not lying free in the joint in any instance. Oblique views of the ankle were useful in demonstrating the lesions.

6. Treatment consisted of operative removal of the fragment and curettage of the necrotic bone.

793 Main Street East
Hamilton, Ontario
Canada

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SUMARIO

Osteocondritis Disecante del Tobillo, con Historias de Cuatro Casos Comprobados

La osteocondritis disecante se presenta en el tobillo, pero no es frecuente en dicho sitio, pues la literatura no revela más que 20 casos hasta 1941. En este trabajo descríbense cuatro casos comprobados: en 3 estaba afectada la porción meso-superior de la cara articular y en 1 el borde latero-superior. La edad de los enfermos varió de 19 a 55 años, promediando 30. Tres de los enfermos eran varones. Los síntomas habían durado de una semana a unos 6 ó 7 años. En 3 casos había antecedentes indicativos de traumatismo.

Los hallazgos radiológicos fueron muy semejantes a los de la osteocondritis disecante de la rodilla. Subyacente al cartílago articular de la cara anterior del astrágalo observóse un fragmentillo óseo en forma de botón, rodeado de una estrecha zona radiolúcida. En ninguno de los casos se hallaba libre en la articulación el fragmentillo óseo. Las vistas oblicuas del tobillo resultaron útiles para descubrir las lesiones.

El tratamiento consistió en la extirpación quirúrgica del fragmento y el raspado del hueso necrosado.

Rupture of Small Intestine Complicating Injury of Pelvis

Report of Two Cases with Recovery after Delayed Diagnosis and Operation[1]

D. ALAN SAMPSON, M.D.,[2] and HERBERT M. STAUFFER, M.D.[3]

Philadelphia, Penna.

THE TERM "subcutaneous rupture of the small intestine" designates that condition in which there is severance of the continuity of the small bowel beneath an intact abdominal wall. Very frequently this rapidly fatal injury is unattended by even the slightest contusion of the superficial tissues. Ordinarily it has followed a sudden unexpected blow to the unprotected abdominal wall, as in being thrown against the handles of a motorcycle, falling against solid objects, automobile accidents, kicks in the abdomen, or the rapid opening of a parachute (8). It has also resulted from muscular effort (1, 10). Counseller and McCormack (3) state that intestinal rupture can be caused in three ways, by crushing, tearing, or bursting. According to Tinsman and Barrow (8), the rupture is rarely multiple, is located in the upper jejunum or lower ileum, and may be due to impingement of the intestine on the vertebral column or on the promontory of the sacrum.

In the presence of other severe injury, the possibility of intestinal rupture may be overlooked. While in many cases of non-penetrating trauma, an immediate diagnosis of intestinal rupture can be made because of signs of rapidly developing peritonitis, and possibly by roentgen demonstration of free air in the peritoneal cavity, one must always bear in mind that in other cases a delusive calm may mark the picture. Metheny (6) points out that, although the manifestations of peritonitis will develop rapidly if there be immediate and gross contamination of the peritoneal cavity, on the other hand, should there be very little contents in the gastro-intestinal tract, signs of peritoneal irritation will not develop until such contamination occurs. Thus gross soiling and board-like rigidity may not be present until twelve to twenty-four hours after rupture; early diagnosis depends on the importance attached to the progress of lesser signs developing during this interval.

The ease with which an early diagnosis may be obscured, and operation delayed, has also been stressed by Veal and Barnes (9), who warn that only when the peritonitis is generalized will there be a silent abdomen; that in ruptures of the lower ileum, the intestinal contents may gravitate to the pelvis with the production of only a localized peritonitis, peristalsis being heard elsewhere. The failure to appreciate this possibility may lead to a mistaken sense of security. Thus in one of their cases (as in numerous others recorded in the literature) a fatal result ensued, while in two others the diagnosis was not made until a walled-off abscess had formed, with recovery after drainage.

The clinical manifestations of non-penetrating subcutaneous rupture are well described by Counseller and McCormack (3) Veal and Barnes (9) and Hunt and Bowden (4), to whose papers the reader is referred. Vomiting after recovery from shock is a valuable early symptom; rigidity is the most valuable single sign. Various criteria for diagnosis are described. According to Poer and Woliver (7) and Tinsman and Barrow (8), intelligent suspicion may depend on nothing more than a definite rise in the pulse rate or the absence of peristaltic sounds. Wilensky and Kaufman (10) contend that early exploration rather than watchful waiting should be the rule.

[1] Accepted for publication in October 1946.

[2] Radiologist, Episcopal Hospital, Philadelphia, Penna.; Associate in Radiology, Graduate School of Medicine, University of Pennsylvania.

[3] Now Assistant Professor of Radiology, University of Minnesota School of Medicine.

Roentgen examination of the abdomen may confirm the suspected diagnosis of intestinal perforation. As early as 1924 Massie (5) cited a case of rupture of the jejunum in which, by x-ray studies, a localized pneumoperitoneum was demonstrated to the left of the second lumbar vertebra. He pointed out that in injuries of the lower abdomen, the pneumoperitoneum may remain localized, that the gas may pass upward only as far as the attachments of the transverse mesocolon. Christopher (2) in 1934 reported a case of intestinal rupture with the patient in good general condition and free from pain; roentgen examination in the erect position revealed free air beneath the diaphragm. Veal and Barnes (9) state that a careful x-ray study should be made in all suspected cases. In three of their six cases in which a film of the abdomen was obtained, the diagnosis of intestinal rupture was confirmed by finding free gas in the peritoneal cavity.

Even with prompt operation, the mortality rate is high. In the series of 1,476 cases collected from the literature by Poer and Woliver (7), 1,014 were submitted to operation, with 603 deaths, an operative mortality of 59.5 per cent. Wilensky and Kaufman (10) state that the mortality rate is 40 per cent for patients operated on within twelve hours, 71 per cent between twelve and twenty-four hours, and 84 per cent after twenty-five hours. Among the 462 non-operated cases in the series of Poer and Woliver there were no survivals. With the exception of the two cases cited by Veal and Barnes (9), in which recovery followed drainage of walled-off abscesses, we have found no record in the literature of survival when operation had been delayed beyond a number of hours.

In view of the experience of other observers, we consider it noteworthy that we, as radiologists, should have encountered, within a few months of each other, two cases of subcutaneous rupture of the small intestine complicating pelvic injury, with survival for months after the injury. In neither case had the diagnosis been suspected. In each instance roentgen studies revealed certain abnormalities of the small intestine not interpreted as due to rupture but of sufficient importance to warrant the operation which established the diagnosis and at which the results of injury were remedied, with resultant restoration to normal function.

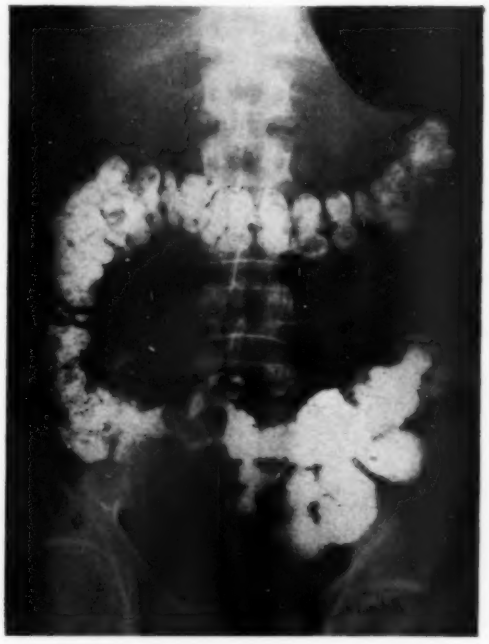

Fig. 1. Case 1, two months after injury. Disturbance of barium pattern in small intestine due to establishment of false passage between torn ends of ruptured ileum, indicated by arrows. Roentgenogram (Oct. 16, 1944) shows mild distention of small intestine at five hours. False passage well visualized. Fractured transverse processes are also shown. Symphysis has been restored to normal width. See also Figs. 2 and 3.

CASE REPORTS

CASE 1: On Aug. 17, 1944, a white male, aged 41, employed as a railroad brakeman, was accidentally pinned between the couplings of two box cars. He was admitted to the Episcopal Hospital, Philadelphia, in great pain, with a clinical diagnosis of fracture of the pelvis. There was no evidence of rupture of the bladder; although the patient was unable to void, catheterization yielded 500 c.c. of clear urine. He vomited three times during the day of admission.

Roentgen examination of the pelvis at admission revealed marked widening of the symphysis pubis. The separation between the pubic bones measured 2 cm. In addition, there was widening of the left

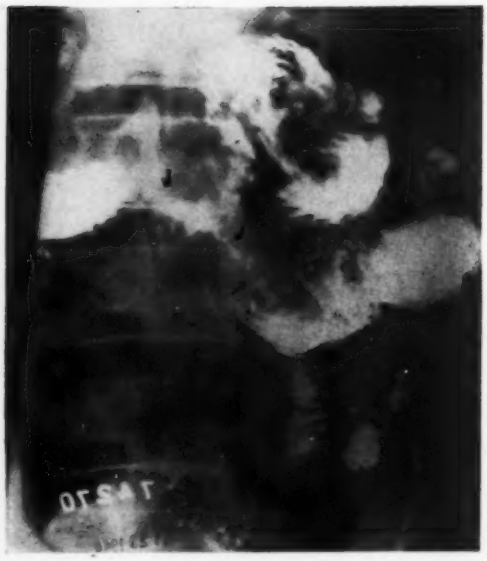

Fig. 2. Case 1. Spot film (Oct. 23, 1944) seventy minutes after ingestion of barium.

sacroiliac joint but none of the right. No fracture was detected anywhere in the pelvis. There was, however, a fracture of the left transverse process of the fourth lumbar vertebra, the only vertebra shown by this examination.

On Aug. 19 the patient was placed in a Weil sling. Vomiting occurred numerous times during the first few days after admission. On Aug. 18 the abdomen, which had previously been only slightly distended, although with marked tenderness in the left lower quadrant, was found to be board-like and exquisitely tender over all four quadrants. Hiccoughs were troublesome, and peritonitis was suspected. However, retroperitoneal hemorrhage was considered the probable cause of these manifestations. Subsequently the patient's general condition improved, although bouts of vomiting occurred at intervals.

During the first ten days after entry the temperature ranged up to 103°, usually about 100°; the pulse ranged between 72 and 100, the respirations averaged 24. Subsequently the temperature did not exceed 99.4° except on a few occasions. The white blood count on ten determinations from Aug. 17 through Sept. 28 varied between 11,900 and 23,100, averaging 17,400.

On Oct. 12 the patient was removed from the sling and the pelvis was re-examined roentgenographically. The symphysis pubis was found to be practically normal in width, with the right pubic bone only about 3 mm. higher than the left. The left sacroiliac joint was also practically normal in width. Because of the vomiting and persistence of abdominal pain, roentgen studies of the gastro-intestinal tract were carried out at this time (Oct. 16 and Oct. 23). The stomach was found to be normal, with no disturbance of motility; at two hours it contained only a trace of barium. However, by exposure of serial films for visualization of the small intestine, an obstruction was demonstrated in the lower abdomen near the mid-line. Spot films exposed at seventy minutes following ingestion of the barium showed a region of narrowing of the small intestine in the lower central abdomen. The jejunum proximal to this obstruction was grossly dilated. Al-

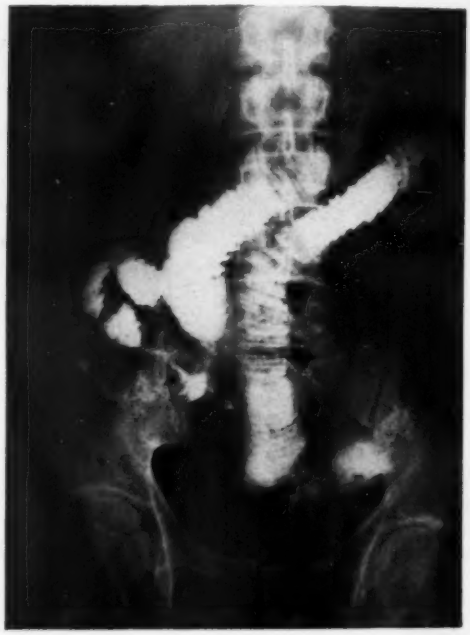

Fig. 3. Case 1. Distention of intestine well shown at four and a half hours (Oct. 23, 1944).

though the head of the barium column entered the cecum at five hours, there remained localized collections of barium in the small intestine in the lower abdomen, and even at twenty-four hours there was still a small quantity of barium present. The examination was interpreted as demonstrating the presence of adhesions (Figs. 1–3).

Laparotomy was performed Oct. 26. It revealed complete transverse laceration of the terminal ileum, which had been walled off by inflammatory tissue consisting of omentum and part of the sigmoid colon, which had been drawn over. These adhesions were broken up and the sigmoid was restored to the normal anatomic position. An end-to-end entero-enterostomy was performed.

The patient's recovery was complicated by an incisional hernia, which was repaired at a secondary operation in February 1945. Roentgen studies Aug. 23, 1945 (eight months after operation) showed

satisfactory functioning of the small intestine with no residual obstruction.

Comment: In this case the severity of the pelvic injury caused the possibility of injury to the small intestine to be overlooked. The clinicians caring for this patient stated that following admission, and for many days thereafter, shock was so great that, even had the diagnosis been suspected, operation would have resulted in death. The fact that the patient survived may seem to indicate that, if operation be delayed more than a period of hours, the chances of recovery may be greater if treatment be conservative, giving the abscess an opportunity to wall-off, as occurs in the development of an appendiceal abscess.

The roentgen findings are interesting. There was obviously an obstruction of the small intestine, with a fairly extensive region of narrowing in the lower abdomen. Post-traumatic adhesions, possibly due to an intraperitoneal hemorrhage, were considered the probable cause. That adhesions were present was demonstrated at operation, but the cause was not suspected by the radiologist. In retrospect, it is possible to recognize the false passage between the torn ends of the ileum (Fig. 1), a region in which there is no semblance of any mucosal pattern.

CASE 2: A member of the United States Naval Women's Reserve, 30 years of age, sustained a compound fracture of both bones of the right leg when she was struck by an automobile on Jan. 30, 1944. There was considerable soft-tissue destruction, necessitating amputation two days later, which was performed at the junction of the middle and lower thirds of the right femur. Subsequent x-ray studies disclosed fractures at the right pubo-ilial junction and the right pubic body, a comminuted fracture of the right ala of the sacrum (Fig. 4), and fractures of the right 8th to 11th ribs, inclusive; all of these had healed at the time of roentgen examination but from the available history could be attributed to the automobile accident.

Beginning in May 1944, shortly after transfer to the U. S. Naval Hospital, Philadelphia, for fitting of a prosthesis, the patient began to experience recurring attacks of pain in the right lower quadrant of the abdomen, accompanied by pain on urination, each attack lasting about a week. During these episodes there were tenderness and a varying degree

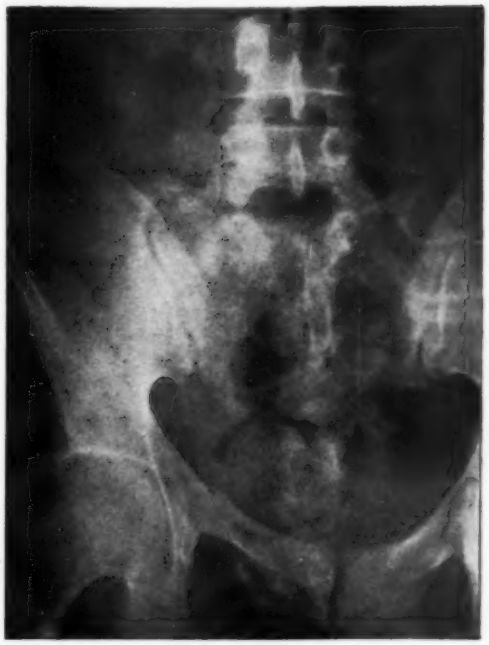

Fig. 4. Case 2. Roentgenogram of pelvis eleven months after injury. Healed pubic fractures on right.

of increased resistance to palpation of the right lower abdomen. Slight temperature elevation without leukocytosis was observed during these attacks, which subsided under conservative treatment. Urologic study, including intravenous urography on Aug. 3, 1944, failed to provide evidence of any urinary tract disturbance to account for the abdominal pain.

Because of pain in the amputation stump and "phantom" limb pain, a plastic repair of the stump and neuroplasty of the right sciatic nerve were performed on Nov. 17, 1944.

The right lower quadrant pain and tenderness continued to recur intermittently, and on Jan. 29, 1945, a barium enema examination revealed persistent abnormal indentations in the most proximal segment of the large bowel which could be filled, presumably the cecum; it was found impossible to fill the terminal ileum during this study. Oral administration of barium resulted in demonstration of an attenuated segment of terminal ileum several centimeters in length immediately proximal to the ileocecal junction. Marked distortion of the cecum was observed (Fig. 5). In view of the local tenderness and the appearance of the bowel, a roentgen diagnosis of inflammatory ileocecal mass was offered.

The abdomen was opened Feb. 20, 1945, more than a year after injury. The transverse colon and a loop of ileum 12 inches from the ileocecal valve were found bound in a mass involving these two struc-

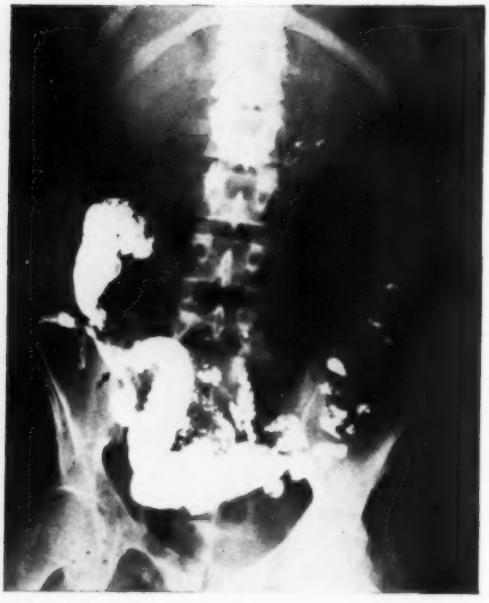

Fig. 5. Case 2. Narrowing of terminal ileum shown following oral administration of barium.

tures and the cecum, and adherent to the posterior portion of the iliac bone at the site of an area of inflammation in the region of the ileocecal valve. A perforation of the ileum near the ileocecal valve was found within this inflammatory mass. The abnormal intestinal opening was closed and an ileocolostomy was performed.

Convalescence was slow. On April 28, 1945, an abscess, containing 6 to 8 ounces of purulent material, situated between the cecum and surface of the ilium, was drained, and subsequently a fecal fistula developed. On Aug. 3 the abdomen was re-entered. The cecum and terminal ileum were dissected from the fistulous tract to the exterior. It appeared as if the opening in the ileocecal region previously closed by suture had reopened and formed the fistula. The ileocolostomy was functioning in excellent fashion, and the terminal ileum was therefore divided from the cecum and the end of each closed.

The subsequent course has been uneventful, the fistula healing by granulation and bowel function returning to normal. At the time of writing (October 1945), the patient is ambulatory, using an artificial limb successfully.

Comment: This case closely resembles Case 1. Pelvic and other injuries caused the possibility of intestinal injury to be overlooked. In view of the lapse of five months between the time of injury and the onset of gastro-intestinal symptoms, it is probable that the intestinal rupture was small and that the slow escape of intestinal contents from it favored the formation of a localized abscess, overlooked because shock was attributed to skeletal damage.

The roentgen studies, as in Case 1, were correctly interpreted as indicating the presence of inflammatory changes with resultant constriction of the ileum and interference with the passage of contents through it.

SUMMARY

Two cases of subcutaneous non-penetrating rupture of the small intestine are reported. These cases are remarkable in that survival occurred in spite of delay in diagnosis and operation, in one case of more than two months, in the other case of nearly thirteen months, whereas the mortality rate in such delayed cases has previously been considered 100 per cent. In one case roentgen studies demonstrated the existence of a fistulous tract between the torn ends of the small intestine. In both cases they showed considerable localized obstruction due to post-traumatic inflammatory changes. No other such cases, with roentgen studies, have been found in a search of the literature.

Episcopal Hospital
Front St. and Lehigh Ave.
Philadelphia 25, Penna.

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SUMARIO

Rotura del Intestino Delgado como Complicación de Lesión de la Pelvis. Reposición a pesar de la Tardanza en el Diagnóstico y la Intervención. Comunicación de Dos Casos

Comunícanse dos casos de rotura subcutánea no penetrante del intestino delgado. Estos casos son notables por haber sobrevivido los enfermos a pesar de la tardanza en el diagnóstico y la operación, que en un caso se demoraron más de dos meses, y en el otro casi trece meses, aunque la mortalidad en esos casos tardíos se había fijado previamente en 100 por ciento. En un caso los estudios radiológicos habían revelado la existencia de una fístula entre los extremos desgarrados del intestino delgado, y en ambos considerable obstrución local debida a alteraciones inflamatorias post-traumáticas. Una pesquisa de la literatura no ha revelado casos semejantes en que se hicieran estudios roentgenológicos.

Adrenal Tumor of the Liver in a Child

Case Report with Roentgenologic Features[1]

HERMAN SELTZ, M.D.

Elkins, W. Va.

ADRENAL rests have been described throughout the upper part of the abdomen in the vicinity of the adrenals. Morgagni (7), in 1740, was the first to describe such accessory adrenal tissue, and Chiari (3), in 1884, was the first to report its malignant transformation. Ewing (5) referred to Schmorl as recording the occurrence of adrenal rests in the liver and also tumors possibly arising from these rests, grossly resembling adrenal tumors. MacMillan and Gilbert (8) reported an aberrant tumor of the upper abdomen in a fifty-one-year-old woman, with a six-year cure. Griffith and Mitchell (6), in their text on *Diseases of Infants and Children*, stated that they had seen a case of adrenal tumor of the liver. Nelson (9) published a series of 19 cases of accessory adrenal cortical tissue, of which 15 were in adults, but in none was the ectopic tissue located in the liver.

The following case is reported because of the unusual location, in the liver, of a large ectopic adrenal tumor and the associated roentgen findings which aided in its localization.

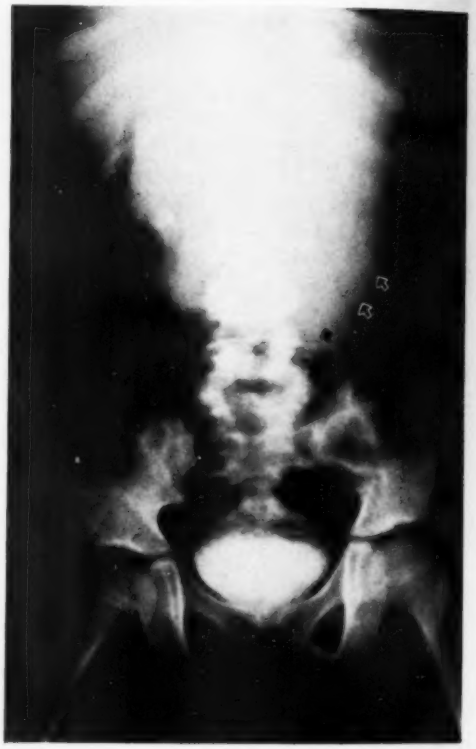

Fig. 1. Excretion urogram showing normal urinary tract bilaterally. The large liver tumor is well demonstrated (arrows). The gas-filled duodenum is displaced to the right and the transverse colon inferiorly.

CASE REPORT

H. F., a 9-year-old boy, was admitted to the Davis Memorial Hospital on Dec. 26, 1945, for observation because of a "lump in the stomach," which his aunt had noticed six weeks earlier while giving him a bath. The patient was a normally active child with no complaints. His appetite was fair. He had no nausea, vomiting, hematemesis, or abdominal pain. His stools appeared normal. He had no symptoms referable to the genito-urinary system. There had been no weight loss. The mother stated that the child had jaundice at the age of three months, but this had cleared spontaneously within a few weeks.

Temperature, pulse, and respiratory rate were normal. The child did not appear chronically ill except for a slight pallor. His nutrition was good, and he appeared to be normally developed for his age. There was no lymphadenopathy. The heart and lungs were normal. Blood pressure was 104 systolic and 66 diastolic. A large, discrete, firm, non-tender mass was present in the epigastrium and left hypochondrium. The mass extended inferiorly to the umbilicus, was nodular cephalad, and moved moderately with respiration. It did not appear to involve the right lobe of the liver. The spleen was not palpable. There was no evidence of ascites. The clinical impression was: (1) retroperitoneal tumor; (2) pancreatic cyst; (3) cyst or tumor of the left lobe of the liver.

[1] From the Department of Radiology, The Golden Clinic, Elkins, W. Va. Accepted for publication in October 1946.

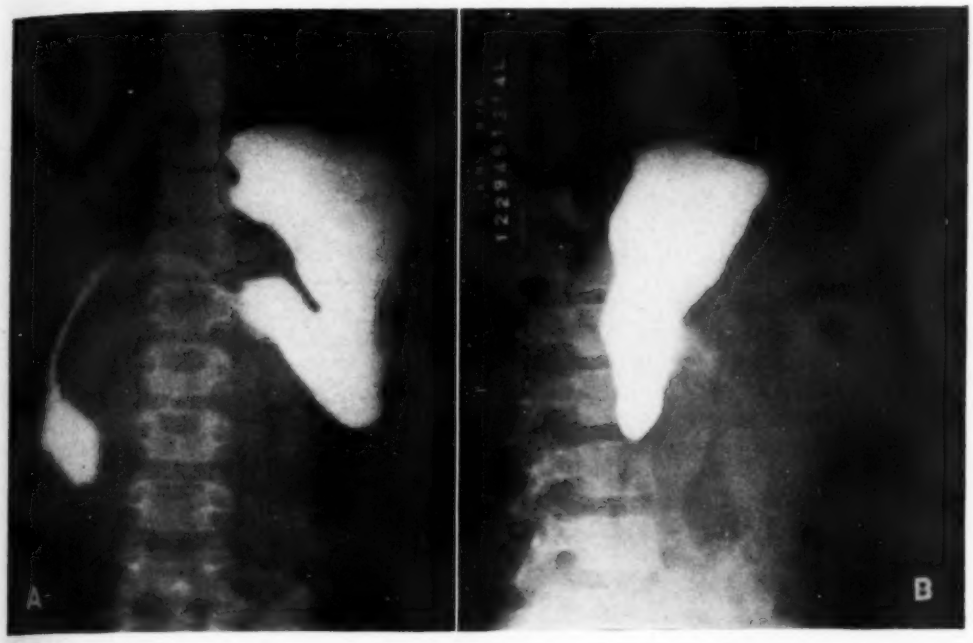

Fig. 2. A. Anteroposterior projection. The barium-filled stomach is displaced to the left, the antral portion of the stomach and duodenal bulb superiorly, and the descending duodenum to the right, by the liver tumor. The marked widening of the duodenal loop suggests a pancreatic lesion.
B. Left lateral projection. The stomach is displaced posteriorly, indicating that the tumor is located anteriorly in the region of the left lobe of the liver.

Laboratory Data: The hemoglobin on admission was 85 per cent; the erythrocyte count 4,020,000; the leukoctye count 6,550, with 63 per cent polymorphonuclears and 34 per cent lymphocytes. Urinalysis showed no abnormality except a 1+ albumin. The sedimentation rate was elevated to 36 mm. in one hour. Icterus index was 7. The plasma protein was 7.5 gm. per cent. The blood sugar was 67 mg. per cent and the non-protein nitrogen 41 mg. per cent. Blood Hinton and Kolmer-Wassermann tests were negative.

Roentgenological Findings: An anteroposterior roentgenogram of the abdomen revealed evidence of a large, hemispherical soft-tissue mass in the epigastrium and left hypochondrium with a fairly well defined inferior border which extended down to the level of L4. The mass caused displacement of the gas-containing stomach to the left and the transverse colon and small intestine inferiorly. The right lobe of the liver did not appear to be enlarged, and its inferior border appeared smooth. The spleen was of normal size. A roentgenogram of the chest was negative.

Intravenous pyelography (Fig. 1) failed to reveal any abnormality of the urinary tract. The epigastric mass did not appear to be related to either kidney.

A gastro-intestinal series (Fig. 2, A and B) showed no intrinsic pathological changes in the esophagus, stomach, duodenum, small intestine, or proximal colon. The body of the stomach was displaced to the left and posteriorly, the pyloric portion and duodenal bulb cephalad, the descending duodenum markedly to the right, and the jejunum and transverse colon inferiorly, by a large epigastric mass in the region of left lobe of the liver. On Dec. 31, 1945, the abdomen was explored.

Operative Findings (Dr. Benj. I. Golden): The abdomen was opened by a left rectus muscle-splitting incision. On reaching the peritoneal cavity, a large, gray, cyst-like mass, about the size of a grapefruit, was seen protruding from the inferior aspect of the left lobe of the liver. The surface of this mass was smooth and highly vascular. Satellite discrete nodules of varying size were scattered throughout the remaining portion of the left lobe; the uninvaded parenchyma was yellow in color. The right lobe of the liver appeared grossly natural. No regional nodes were detected, nor any evidence of intraperitoneal spread. Palpation of the adjacent viscera, including the kidneys and pancreas, failed to reveal any abnormality. Two of the small nodular liver masses and aspiration material from the cyst-like mass were removed for histologic study. *Postoperative diagnosis:* Malignant tumor of the liver.

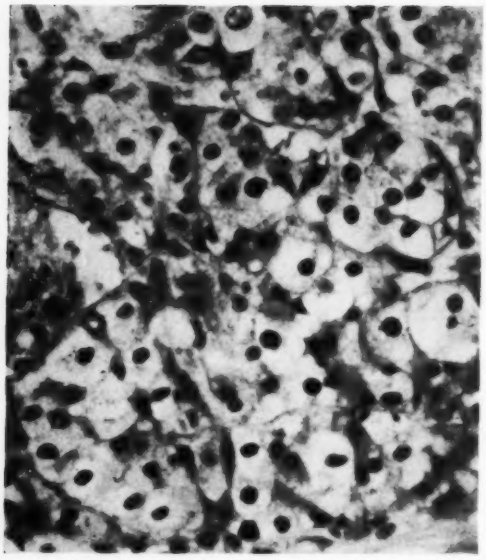

Fig. 3. Section of liver mass (high-power magnification) showing clear polyhedral cells resembling clear-cell carcinoma.

The postoperative course was uneventful except for delayed healing of the abdominal wound. The patient was discharged from the hospital on the nineteenth postoperative day, Jan. 19, 1946. Since discharge he has been seen monthly in the Out-Patient Department. There has been no change in his general condition nor in the size of the tumor.

Histologic Report (Dr. F. Levy): Besides small areas of liver trabeculae, or structures bearing some likeness to them, the specimen showed no similarity to liver tissue. Instead of lobulae, irregular masses of more or less polyhedral cells were found (Fig. 3), many of which were similar to the typical picture of clear-cell carcinoma. A continuous growth was shown by the presence of numerous mitotic figures. Large hemorrhages spread into the tumor as well as into the markedly thickened capsule of Glisson.

The description of the material from the cyst-like mass was as follows: In polarized light, unstained cells are large. Smears show double-refracting substance in the tumor cells as well as extracellularly.

The aspect of the cells, the papillary structures in some parts, the loose relation of the cells to one another in other parts, and the double-refractive cholesterine esters place the growth in the group of hypernephromas. The biopsy permits no conclusion as to whether the tumor arose in or near the kidney, or is a primary growth of extrarenal misplaced adrenal rests, as these are known to occur near the solar plexus or on the inferior surface of the liver. *Pathological diagnosis:* Adrenal tumor in the liver.

Comment: The large mass arising from the inferior surface of the left lobe of the liver in this case produced marked widening of the duodenal loop (Fig. 2, A), suggesting a lesion in the region of the head of the pancreas. The posterior displacement of the stomach (Fig. 2, B), however, was inconsistent with a retroperitoneal pancreatic tumor, and for this reason the mass was considered to be in the region of the left lobe of the liver.

DISCUSSION

Roentgen studies may be of aid in the diagnosis of tumors of the liver in children, especially in localizing the tumor process, though little appears in the literature on this subject. Schatzki (12) presented a roentgenological syndrome based on the frequent association of primary hepatic carcinoma and cirrhosis which he considered highly suggestive of primary carcinoma of the liver. This syndrome consisted in the demonstration of (*a*) cirrhosis (esophageal varices), (*b*) a mass in the region of the liver, and (*c*) positive evidence of carcinoma (metastasis). The syndrome, however, is of little aid in children, since cirrhosis is rarely found in the young.

Hepatosplenography with the aid of intravenous thorotrast has been advocated by some (Ehrlich and Ansanelli, 4) for the diagnosis of tumors of the liver, but this procedure is rarely used by radiologists because of the possibility of late morbid changes due to the radioactivity and/or the foreign-body effect of the medium (Rigler, 11). In more recent years, the attempt has been made (Beckermann and Popken, 2; Olsson, 10) to visualize the liver and spleen with an iodized colloidal emulsion (Iodosol) as a substitute for the thorium suspension, but this, too, is not without serious danger (Olsson, 11).

Displacement and deformity of the adjacent gastro-intestinal organs by a tumor of the liver have been described by others. Abel (1) reported a case of primary carcinoma of the liver in a child, successfully treated by partial hepatectomy of the left lobe. The roentgen diagnosis in this case,

with displacement of the adjacent gastro-intestinal organs similar to our own, was pancreatic tumor.

The stomach, duodenum, small bowel, and transverse colon may all be involved in the displacement process if the hepatic tumor enlarges inferiorly or posteriorly, or only the stomach itself may be displaced. If the duodenal loop is enlarged, the possibility of a tumor of the left lobe of the liver should be excluded by a lateral view. This will show anterior displacement, or no displacement, of the stomach in the presence of a pancreatic tumor or any other retroperitoneal mass in the region of the pancreas, and posterior displacement of the stomach if the mass is hepatic in origin.

If the mass in the liver enlarges cephalad, one may find a localized bulge in the diaphragm, especially on the right side. Too much emphasis cannot be placed on this finding, however, since normal developmental variations in the contour of the diaphragm occur frequently, and other intrahepatic lesions (cyst, abscess and metastatic nodules) may produce a similar diaphragmatic lobulation.

Rarely calcification may occur in a primary carcinoma of the liver. Tomlinson and Wolff (15) reported one such case in an infant with a large liver and scattered areas of calcium density in the right lobe.

SUMMARY

1. A case of aberrant adrenal tumor of the liver in a nine-year-old child is reported.

2. Roentgenologic findings which may be associated with tumor of the liver are discussed. In the case reported, displacement of the adjacent gastro-intestinal organs by the tumor caused marked widening of the duodenal loop on the antero-posterior roentgenogram, suggesting a pancreatic lesion. However the latter could be excluded by a lateral view, showing posterior displacement of the stomach.

The Golden Clinic
Elkins, W. Va.

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SUMARIO

Suprarrenoma Hépatico en un Niño. Historia Clínica con Datos Roentgenológicos

Comunícase un caso de tumor adrenal aberrante del hígado en un niño.

Repásanse los hallazgos radiológicos que pueden asociarse con los tumores hepáticos. En el caso actual, el desplazamiento de los adyacentes órganos gastro-intestinales por el tumor provocó un ensanchamiento pronunciado del asa duodenal en la película anteroposterior, indicando lesión pancreática. Sin embargo, pudo excluirse la última con una vista lateral que reveló desplazamiento posterior del estómago.

Characteristics of X-Ray Films and Screens[1]

RUSSELL H. MORGAN, M.D.
Baltimore, Md.

MOST ROENTGENOLOGISTS have long recognized the need of reliable quantitative data giving the speed, detail, and contrast characteristics of commercially available roentgenographic films and intensifying screens. From such information, the choice of the most satisfactory films and screens for use in a roentgenographic department may be greatly facilitated. Furthermore, the availability of such information to the profession would constantly stimulate the x-ray industry to improve the quality of its products.

Before quantitative data listing the characteristics of films and screens can be made generally available to the radiologist, however, four fundamental steps must be taken. First, standard definitions of speed, detail, and contrast must be established. The terms of these definitions, of course, should correspond as closely as possible to the conditions which occur when the films and screens are used in normal roentgenographic practice. Second, methods of measurement which comply with the standard definitions must be developed. Third, an impartial and able laboratory to carry out such measurements must be set in operation. Fourth, the data must be published at regular intervals in journals that have a wide circulation among radiologists.

During the past year, the laboratory of the Radiology Section, U. S. Public Health Service, has been engaged in investigations from which standard definitions and methods of measurement of the various film and screen characteristics may be derived. Much of this research has been completed and has been reported in previous publications (1) or publications now in preparation. It is hoped that before long quantitative data on the characteristics of all x-ray films and screens will be published regularly in the two leading radiological journals of this country.

Before these data become generally available, it may be of interest to many to observe some of the preliminary results. Measurements have been made of the detail provided by eight types of intensifying screens, one fluoroscopic screen, and several of the screen-lens-film combinations which are used in photofluorography. Data have also been derived for the contrast factors of several photofluorographic films. We are not prepared to issue any speed data on various radiographic materials at this time, since our apparatus for making these measurements has just recently been completed.

DETAIL

The ability to record detail is measured in our laboratory by determining the finest linear pattern which can be resolved by a film or film-screen combination. Most radiographic film-screen combinations are able to resolve patterns up to 10 lines per millimeter. Photofluorographic combinations, however, are generally much poorer, while films exposed to x-rays directly frequently are able to resolve patterns having 50 lines per millimeter. Indeed, the ability of films alone to record detail is so much superior to that of intensifying screens that in the case of a film-screen combination it is the intensifying screens which limit the over-all ability of the combination in this respect. As a result, it makes little difference what brand of film is used in an intensifying screen exposure as far as detail is con-

[1] From the Department of Radiology, The Johns Hopkins Hospital, and the Radiology Section, Tuberculosis Control Division, U. S. Public Health Service. Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

TABLE I: RESOLVING POWER RATINGS OF COMMERCIAL INTENSIFYING SCREENS

Brand	*Resolving Power* (lines per mm.)
Buck Xtra-speed	10
Buck Mid-speed	12 1/2
Buck Detail	12 1/2
Eastman Ultra-speed	9
Eastman Fine Grain	10
Eastman High Definition	12 1/2
Patterson Par-speed	10
Patterson Detail	17 1/2

cerned; for any given pair of intensifying screens the detail will be the same regardless of the type of film used.

The maximum number of lines per millimeter which can be resolved by a film or film-screen combination is called resolving power. Most film-screen combinations now available to the radiologist have resolving powers of approximately 10 lines per millimeter; that is, the finest linear pattern which these combinations can resolve is one having 10 lines per millimeter. In general, resolving power measurements are an excellent index of the detail provided by various radiographic materials. During our preliminary experimental work, radiographs were made with a series of film-screen combinations on which resolving power measurements were made. These radiographs were made under conditions in which loss of detail due to movement of the part under examination and to target size were reduced essentially to zero. Differences, then, in the detail exhibited by the films were the result of differences in the characteristics of the screens themselves. The radiographs were submitted to a large number of radiologists, who were asked to place the films in their order of diagnostic merit. In almost every instance the radiologists' evaluations corresponded to the quantitative resolving power measurements. Only in those instances where two film-screen combinations had almost identical resolving powers were there discrepancies, and even here the radiologist frequently stated that there was no practical difference between the two combinations.

The resolving powers of eight commercially available intensifying screens are shown in Table I. It will be observed that the screens designated as high-speed by various manufacturers generally have slightly lower resolving powers than those marked mid-speed and that the mid-speed screens in turn are slightly poorer than the screens listed as high-definition. With one exception (Patterson Detail screens), however, the difference between the poorest high-speed screen and the best high-definition screen is phenomenally small. Indeed, the difference between the detail provided by screens having a resolving power of 9 lines per millimeter and those having a resolving power of 12 1/2 lines per millimeter is hardly perceptible. This fact may seem strange to many radiologists, because almost everyone can remember a time when it was not difficult to differentiate so-called high-definition screens from so-called high-speed screens from the standpoint of detail. However, with the exception of Patterson Detail screens, all of the present-day brands, regardless of designation, provide about the same detail.

The resolving power of the Patterson type "B" fluoroscopic screen is 6 lines per millimeter. This value may appear unusually high to many readers in view of the rather poor detail which can be seen under fluoroscopic conditions. This poor detail, however, is not the fault of the screen but is due to the diminished visual acuity of the observer at the low levels of illumination occurring in fluoroscopy.

TABLE II: RESOLVING POWER RATINGS OF COMMERCIAL PHOTOFLUOROGRAPHIC SCREENS

Brand	*Resolving Power* (lines per mm.)
Patterson type "B"	6
Patterson type "D"	7
U. S. Radium and Chemical Co. type 666-D	9

The resolving powers of three photofluorographic screens are listed in Table II. It will be observed that the screen produced by the U. S. Radium and Chemical Co. is somewhat superior in this respect to the Patterson screens. All three screens

provide essentially the same speed when used with currently available photofluorographic films. However, Ansco is preparing to place in production a film for use with the Patterson type "D" and the U. S. Radium and Chemical Co. type 666-D that will provide almost double the speed of the type "B" screen-film combination.

The ratings listed in Table II, of course, do not provide a reliable index of the detail visible in photofluorographic films, since the lens of the photofluorographic camera and the graininess of the film cause a considerable loss of detail. The over-all resolving powers of two photofluorographic combinations (screen, lens and film) are listed in Table III. One is for a 35-mm.

TABLE III: OVER-ALL RESOLVING POWER OF TWO PHOTOFLUOROGRAPHIC SYSTEMS (SCREEN, CAMERA LENS AND FILM)

Type of System	*Resolving Power* (lines per mm.)
Patterson type "B" screen plus Eastman Ektar f/1.5 lens plus Eastman yellow-sensitive 35-mm. film	2.0
Patterson type "D" screen plus Eastman Ektar f/1.5 lens plus Eastman blue-sensitive 70-mm. film	2.5

combination and the other for a 70-mm. combination. It will be observed that the latter is only moderately better than the former. However, we have some evidence to indicate that if, in the 70-mm. combination, a Patterson type "B" screen were used with an Eastman yellow-sensitive photofluorographic film, a resolving power approaching 3.0 lines per millimeter may be obtained. This higher resolving power is due to the smaller grain size of Eastman's yellow-sensitive film as compared to its blue-sensitive emulsion. A significant improvement in the resolving power of the 70-mm. combination may also be accomplished by the replacement of the Patterson type "D" screen by the type 666-D screen of the U. S. Radium and Chemical Co. The higher resolving power of the latter screen will do much to counteract the loss of resolving power introduced by the grainy blue-sensitive emulsion.

TABLE IV: CONTRAST RATINGS (GAMMA) OF FIVE PHOTOFLUOROGRAPHIC FILM-SCREEN COMBINATIONS

Film-Screen Combination	*Contrast* (Gamma)
Patterson type "B" screen plus Eastman yellow-sensitive P-F. film	1.6
Patterson type "D" screen plus Eastman blue-sensitive P-F. film	1.4
U. S. Rad. & Chem. Co. type 666-D screen plus Eastman blue-sensitive P-F. film	1.6
Patterson type "D" screen plus Ansco experimental P-F. film	1.8
U. S. Rad. & Chem. Co. type 666-D screen plus Ansco experimental P-F. film	2.0

CONTRAST

Contrast ratings have been determined for five photofluorographic film-screen combinations. These data, listed in Table IV, were determined by measuring the maximum slopes of density *vs.* log exposure curves made experimentally on the several combinations. They represent, therefore, what is usually referred to in the field of photography as gamma ratings. It is interesting to note that the contrast rating of the Patterson type "D" screen-Eastman blue-sensitive film combination is almost 15 per cent lower than that of the Patterson type "B" screen-Eastman yellow-sensitive film combination. In actual practice, the superiority of the latter combination is even greater than indicated, for it has been shown by recent work (2) that the x-ray contrast of images recorded by the type "B" screen is almost 10 per cent greater than that of the type "D" screen. As a result of the marked difference in over-all contrast between the two combinations, most radiologists quickly express a preference for films made with the type "B" screen-yellow-sensitive film combination. However, it will be noted from Table IV that there will soon be available photofluorographic film-screen combinations of the blue-sensitive type that will even surpass the contrast characteristics of any previous combination.

PERSISTENCE OF PHOTOFLUOROGRAPHIC SCREENS

It would be unwise in this discussion of the characteristics of x-ray films and

screens to conclude without saying a word regarding the persistence characteristics of various photofluorographic screens. Persistence, or lag as it is sometimes called, is a phenomenon characterized by the emission of light by a screen after the termination of the x-ray exposure. Some screens, such as the Patterson type "D" screen, exhibit this characteristic to a marked degree, whereas the Patterson type "B" screen has only negligible persistence.

The effect of persistence is twofold in photofluorography. If it is marked, there will be a considerable fogging of the various radiographic images in the film roll. Also, the performance of automatic photoelectric timers may be considerably impaired.

The marked persistence of the type "D" screen is unfortunate, because otherwise this screen has several valuable characteristics. First, its resolving power is slightly better than the type "B" screen. Also, this screen emits blue light and, therefore, employs blue-sensitive films that can be processed in conventional x-ray dark rooms without changing the lighting conditions, in contrast to the yellow-sensitive films that are used with the type "B "screen.

During the past year, many attempts have been made to produce a blue-emitting screen having short persistence characteristics similar to those of the type "B" screen. As Van Allen (3) has recently reported, the U. S. Radium and Chemical Co. has been successful in meeting this objective in their type 666-D screen listed in some of the tables in this article. From laboratory and field tests, this screen seems to have such excellent over-all properties, as well as low persistence values, that before long it will likely receive wide usage in combination with such films as the experimental Ansco emulsion mentioned in Table IV. Such a combination will not only provide superior speed and contrast but a reasonably good resolving power, an absence of annoying persistence effects, and the advantage that the films may be processed under ordinary darkroom conditions.

CONCLUSION

The foregoing are the data that have been collected by our laboratory up to the present time. During the next year, our program will be organized to permit a complete quantitative evaluation of the speed, contrast, and resolving power characteristics of all commercially available x-ray films and screens. This information, soon thereafter, will be published regularly for the guidance of radiologists everywhere.

Department of Radiology
Johns Hopkins Hospital
Baltimore 5, Md.

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DISCUSSION

W. Edward Chamberlain, M.D. (Philadelphia, Penna): Dr. Morgan's paper is of tremendous practical importance, as is all of the work that he and his colleagues do. The thought that we may be receiving in the near future regular published statements regarding the qualities of x-ray films that are commercially available is very interesting.

For a great many years Dr. Henny and I at Temple University have made our own determinations of the contrast and speed of various films available on the open market with some rather interesting results, which, however, we have never ventured to publish, feeling that to do so might perhaps suggest that we were interested in selling a particular product.

I am interested to know what the reaction is going to be when we see set forth in print the differences which we have all observed in the laboratory. After all, the tendency will be for buyers to go rushing from one film to another, because there are very real differences. Every once in a while, we find one particular film standing out quite definitely above all others in the combination of speed and contrast.

A mention of the method we have used for determining some of these factors may be of interest. If you have an x-ray machine organized so that you can measure accurately its output and if you can maintain the quality of the beam constant—and it is not too hard to do that—then you can make, at any time you please, an exposure of a film enclosed be-

tween a particular pair of intensifying screens (carried, of course, in a particular cassette so as to eliminate differences in thickness and radiation absorption of various cassette covers), and then develop the film in a given developer for various lengths of time, and finally, with the densitometer determine exactly how much contrast is produced by the particular combination of film, developer, and intensifying screen used. Our method involves some differences in detail but not in principle from what Dr. Morgan has shown us.

I should like Dr. Morgan in his closing remarks to comment upon the problem of just what the commercial effects of these published statements will be. I think it takes some courage to start putting them in print and yet of course we are glad that it is going to be done.

In closing I want to ask Dr. Morgan a couple of specific questions. When can we expect the new Ansco P-F. film to be available? And is the United States Radium and Chemical Company 666-D Screen now available? If so, where and how do we obtain it. I think you all feel as I do. Those of you who have worked with P-F. films realize that there is something to be desired in the present combination of blue-screen and blue-sensitive film partly because of the persistence or lag in the screen and partly because we'd like to have more contrast in our results.

Russell H. Morgan, M.D. (*closing*): I will answer briefly Dr. Chamberlain's questions.

First of all, he asked what reaction we expect from the x-ray industry in regard to the publication of quantitative information regarding screens and films. We have already had a chance to see what that would be. We have been publishing some of this material in various issues of *Public Health Reports*. This journal doesn't have a very wide distribution among radiologists but we have been using it as a method of exploring reaction among those who do get that journal from time to time, and all that I can say is that this reaction so far has been most favorable. The x-ray industry has been extremely co-operative with us in all of this work and I think that the whole thing will go very smoothly indeed.

As to the availability of the United States Radium Company's screen and also of the new Ansco film, the screen, I believe, will be available within a period of weeks. As far as the film is concerned, it will probably be a matter of not longer than one or two months. Accordingly I think that the quality of photofluorographic films should take a marked step forward soon after the turn of the year.

SUMARIO

Características de las Películas y las Pantallas Roentgenológicas

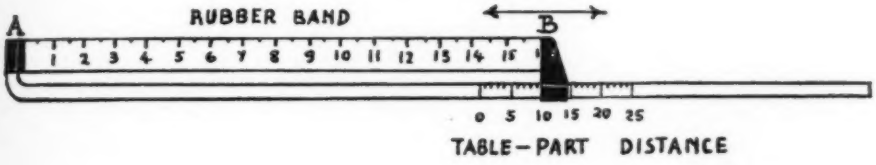
Preséntanse datos relativos a la facultad resolvente, que constituye un índice de la capacidad para reproducir detalles, de 8 pantallas intensificadoras y 3 pantallas fotorroentgenográficas obtenibles en el mercado. También se suministran los coeficientes de comparación determinados para 5 combinaciones fotofluorográficas de película-pantalla. Por fin, se discute la "persistencia," es decir, la emisión de luz después de terminar la exposición a los rayos X, de varias pantallas fotorroentgenográficas.

Elastic Ruler for Roentgen Pelvimetry[1]

CESARE GIANTURCO, M.D.
Urbana, Ill.

ELASTIC rulers have found use in radiology for the determination of the position of the pineal gland. They can also be used to good advantage to simplify roentgen pelvimetry.

The figure below shows an elastic ruler consisting of a metal rod bent at one end (A) and carrying a movable piece (B). A rubber band is fastened to A and B.



By moving B, the rubber band can be stretched and held at any point along the shaft. The original length of the rubber band is 14 cm. After stretching it to 16 cm., 16 centimeter lines are marked on it.

Let us now take six metal rods, all 16 cm. long, and place them on the x-ray table supported by radiolucent material so that one rod will be at table top level, and the others at 5, 10, 15, 20, and 25 cm. above the table top. A film of these six rods is then taken with Bucky and with the film-tube distance that one intends to use for pelvimetry.[2] This film is placed on an illuminator and the rubber band is stretched so that its length will correspond to the shadow of the 16 cm. rod placed on the table top. The position of the movable piece (B) is now marked on the metal shaft. Assuming that the shadow of the 16 cm. rod placed on the table top becomes 17.6 cm. when it reaches the film in the Bucky, the rubber band will distribute this increase over its entire length so that the distance between centimeter marks will be 11 mm. instead of 10 mm. The rubber band is then stretched so that its length corresponds to the shadow of the 16 cm. rod placed 5 cm. above the table top and the new position of the movable piece is marked on the metal shaft. This is repeated for the rods placed at 10, 15, 20, 25 cm. above the table top, and new marks are made on the shaft for each position of the movable piece (B). The spaces between marks are then further divided into five equal spaces, each of which represents one centimeter of table top-part distance.

Once this is done, pelvimetric measurements become extremely simple. One anteroposterior axial film and one lateral film are taken, and the distance in centimeters between the table top and the inlet and the distance between the table top and the sagittal plane of the patient are noted.

The anteroposterior axial film is measured with the ruler set at first for the table top-inlet distance. At this setting, one can measure the true conjugate, the fetal head, the transverse diameter, and the two oblique diameters. A setting of 4 cm. will measure accurately enough the interspinous diameter, and a setting of 1.5 cm. the bi-ischial.

On the lateral film, one must set the instrument for the distance between the table top and the sagittal plane of the patient. This setting will serve for the true

[1] Accepted for publication in October 1946.
[2] In this method, as well as in other methods of pelvimetry, accuracy will be increased by the use of a long tube-film distance.

conjugate, the pubosacral diameter, and the fetal head.

As long as the tube-film distance is kept constant, the measurements obtained with the elastic ruler are quite as accurate as those obtained by other methods. The advantages of the method rest in its simplicity, in the economy of time and materials, and in the fact that measurements can be easily obtained on wet films.

Carle Hospital Clinic
Urbana, Ill.

SUMARIO

Regla Elástica para la Pelvimetría Roentgenológica

Descríbese una regla elástica para empleo en pelvimetría, cuyas ventajas comprenden sencillez, ahorro de tiempo y material y facilidad para hacer mediciones en películas húmedas.

EDITORIAL

Vagotomy in the Treatment of Peptic Ulcer

The therapy of peptic ulcer has passed through numerous stages but has never been established on an entirely satisfactory basis. Treatment has included various types of medical management with alkalinization as the basic factor and such surgical procedures as gastro-enterostomy, local excision of the ulcer, and more recently partial gastrectomy. Associated with all of these measures are certain disadvantages which have prevented their universal acceptance as an ideal method of treatment.

In 1943, Dragstedt and Owens (2) reported their experience with supradiaphragmatic vagotomy in two cases of duodenal ulcer. This procedure they based upon the concept that such ulcers are attributable to the corrosive action of the gastric juice, excessive secretion of which may be due to hyperactivity of the gastric secretory fibers of the vagus nerves. In both cases satisfactory results were achieved.

This communication was followed in 1944 by a more detailed study by Dragstedt, Palmer, Schafer, and Hodges (3), of 11 patients with gastric and duodenal ulcers similarly treated. In this paper the authors discuss at some length the relation of gastric secretion to ulcer formation. They cite the work of Carlson, who showed that even in the fasting state and in the absence of psychic stimuli there is normally a more or less continuous secretion of gastric juice. What causes this is unknown, but it is assumed to be due, at least in part, to a persistent secretory tonus of the vagi. Under normal conditions, the gastric wall is not digested because it is not exposed to pure gastric juice for long periods but is protected by the introduction of food. The pancreatic juice, gastric and intestinal mucus, duodenal juice, and bile offer further protection to the duodenum and to a less extent to the gastric and jejunal mucosa. When, however, excessive volumes of gastric juice are secreted continuously in experimental animals, especially in the absence of food, this defensive mechanism is overcome and an ulcer is produced. In a considerable number of ulcer patients there is also evidence of excessive production of gastric juice in the absence of any obvious stimulant, as at night when the stomach has been previously emptied of food by lavage. Follow-up observations of the 11 patients treated by Dragstedt and his associates by vagus section showed a striking decrease of this high night secretion following the operation, the reduction in most cases being in excess of 50 per cent. Associated with this there was persistent relief of ulcer pain and distress.

The observations recorded above were supplemented by physiological studies by Thornton, Storer, and Dragstedt (8) to determine the effect of vagotomy on the gastric secretory response to histamine, caffein, insulin hypoglycemia, and a "sham meal" in which food was chewed but not swallowed. The increase in the volume of gastric secretion and free acid regularly produced by histamine and by caffein was unchanged following vagotomy, indicating that the action of these stimulants is probably directly upon the gastric glands. On the other hand, the increase in secretion normally observed in the presence of insulin hypoglycemia and following a sham meal was completely abolished in vagotomized patients, confirming observations of others that these agents act through

stimulation of the gastric secretory fibers of the vagi. The absence of a secretory response to insulin or a sham meal is therefore suggested as a good test of the completeness of section of the vagal fibers.

A clinical study of 50 chronic ulcer cases treated by transthoracic vagotomy has recently been reported by Smith, Ruffin, and Baylin (7). All the patients in this series had chronic or recurrent ulcers which had failed to respond to previous medical or surgical measures, with symptoms ranging in duration from two to thirty-five years. Complete clinical recovery was obtained in 43 cases and the patients were able to return to a full, unrestricted diet. There was one questionable recurrence and one postoperative death. Five patients were relieved of ulcer symptoms but suffered from gastric retention, vomiting, persistent diarrhea, weakness, nervousness, or other symptoms. In this series, as in other reported series, the most common and serious postoperative complication was gastric retention associated with dilatation and hypoperistalsis, occasionally necessitating a secondary operation for relief. When a previous gastro-enterostomy had been done, no such difficulty was encountered. Diarrhea occurred in 27 patients but in 19 it was of only a few days' duration. Transient chest pain and fluid in the pleural cavity were minor complications.

Roentgen studies on this series of patients showed varying degrees of obstruction; the six-hour gastric residue ranged from 100 per cent to almost none. The duodenal bulb was frequently difficult to visualize. No point tenderness was present in most cases. The majority of the ulcers showed roentgen evidence of healing within several weeks or months.

Postoperative observations have also been reported from Massachusetts General Hospital, by Moore, Chapman, Schulz, and Jones (6), whose experience with vagotomy in ulcer cases covers two years. Of their 40 patients, 33 were followed long enough for an evaluation of progress. In 32 of these cases there was healing of the original ulcer but in 2 cases pain continued and in one a late gastro-enterostomy was required. Of the 29 patients classified as showing satisfactory results, there were 3 who had diarrhea persisting from three to five months, and 2 others with postprandial symptoms of epigastric pressure and faintness. The diarrhea ceased spontaneously in all cases, but one patient still complained of postprandial distress after two years. No recurrences have been encountered in this series.

Attempts are being made to overcome the complication of gastric retention with lack of tone and decreased peristaltic activity. Machella, Hodges, and Sorber (4) gave urethane of B-methyl choline chloride to two patients with disturbances of the motor function of the stomach following bilateral vagotomy for ulcer, and showed by roentgenologic and balloon-kymographic studies that the parenteral introduction of this drug temporarily restored gastric peristalsis and motility with relief of epigastric distress, anorexia, and nausea. A side effect of this was an increase in gastric acid secretion in the fasting stomach, which may or may not be detrimental to ulcer healing.

It is known that in a certain number of cases the vagi do not consist of two main trunks but divide and form a plexus in their lower course. This has caused some uncertainty concerning the proper site for section of the nerves. Dragstedt in his earlier cases, and most of the authors quoted above, have used the supradiaphragmatic route to insure section of all the nerve fibers. This, however, precludes visual and manual observation of the lesion under treatment, and thus allows for the possibility of an incorrect diagnosis. Recently Dragstedt has switched to the transabdominal approach in order to have the additional advantge of inspection of the ulcer. Differences of opinion as to the comparative effectiveness of the two procedures remain to be settled. As a result of an anatomic study of the vagus nerves at the postmortem table, Bradley, Small,

Wilson, and Walters (1) believe that in more than 90 per cent of cases, a subdiaphragmatic approach will allow as nearly a complete division of all the nerve fibers as a transthoracic approach. Miller and Davis (5), however, as a result of a similar study, strongly favor the supradiaphragmatic approach, feeling that otherwise some of the nerve branches may be missed.

The preliminary reports on vagotomy in the treatment of peptic ulcer are encouraging, but the interval since its introduction is short. A much longer time will be required to evaluate fully the place of this procedure in ulcer therapy. It represents primarily a physiologic approach to the problem and should stimulate further physiologic studies to determine finally the effect not only on the stomach but on the other abdominal organs. The immediate relief of ulcer symptomatology is dramatic, but the subsequent gastric atony and delay in motility occasionally observed may be very distressing, although in most cases these after effects eventually disappear. The volume and acidity of the gastric juice are significant factors in the production of peptic ulcer. Vagotomy done in connection with partial gastrectomy would appear to be of definite value in modifying gastric secretion and thus acting to prevent the development of gastrojejunal ulcers frequently observed as a complication of the latter operation.

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An Announcement
Publication of Spanish Summaries

With this issue, Radiology embarks upon a new undertaking, which it is anticipated will greatly increase its usefulness, namely, the publication of summaries in Spanish of all original contributions appearing in its pages.

Barriers of language have never been effective in halting the advance of scientific achievement, but that they may hinder the prompt exchange of useful experiences is undeniable. We believe that Latin American radiologists will welcome the opportunity to follow, month by month, the work of their North American colleagues, while our own interest in the contributions of Latin America to our common specialty will be enhanced by the closer relationship thus established.

If proof were needed of the international character of the science of radiology and the community of interest existing among radiologists of the Americas, it was amply demonstrated by the recent Inter-American Congress of Radiology at Havana and the action there taken toward the establishment of an Inter-American College of Radiology. It is our hope that the new policy of making available in Spanish the substance of our current publications will be yet another bond between radiologists of the Western Hemisphere.

Publicación de Sumarios en Español

Con la esperanza de que acreciente considerablemente su utilidad, sobre todo en la América Latina, RADIOLOGY lanza, con este número, una innovación, o sea, la publicación en castellano de sumarios de todos los trabajos originales que aparezcan en sus páginas.

Las vallas del lenguaje jamás han logrado contener el adelanto científico, pero tampoco cabe negar que pueden impedir el rápido intercambio de conocimientos útiles. A nuestro parecer, los radiólogos latino-americanos acogerán con placer la oportunidad de seguir, en su propio idioma, de mes en mes, la labor de sus colegas del Norte, en tanto que nuestro propio interés en los aportes latino-americanos a nuestra mutua especialidad se verá avivado por las relaciones más íntimas así establecidas.

Si se necesitara mayor prueba de la naturaleza internacional de la ciencia radiológica y de la mutualidad de intereses que existe entre los radiólogos de las Américas, bien amplia la ofreció el reciente Congreso Inter-Americano de Radiología celebrado con tanta brillantez en la Habana y la decisión allí tomada con respecto al establecimiento de un Colegio Inter-Americano de Radiología. Abrigamos la sincera esperanza de que la nueva política de presentar en español la sustancia de nuestros trabajos corrientes forje otro lazo de unión entre los radiólogos del Hemisferio Occidental.

ANNOUNCEMENTS AND BOOK REVIEWS

PRESENTATION TO DR. R. S. STONE

For reasons metallurgical, the Gold Medal of the Radiological Society of North America awarded to Dr. R. S. Stone was not ready for presentation at the time of the Annual Meeting of the Society last December. It was completed in the spring of this year, and the Secretary of the Society suggested to the President-Elect that, since he resided in the same city as Dr. Stone, he present the medal at some suitable occasion. The latter was kindly arranged at a meeting of Dean Smith, of the University of California Medical School, and Dr. Childs.

Accordingly, at the May 24, 1947, Faculty Meeting of the University of California Medical School, the award was made, with the following remarks by Dr. L. H. Garland:

"Gentlemen: It is a high privilege indeed to come before the faculty of the Medical School of the University of California with this so pleasant task.

"The Gold Medal of the Radiological Society of North America has not been awarded since 1941. Its prior recipients include many distinguished physicians and physicists, amongst whom one recollects Gösta Forssell, Madame Curie, Maud Slye, Arthur Compton, Robert Millikan, Edith Quimby, and others. These names are lustre in the quiet halls of science, and shed a glow of brilliance in our world. To this outstanding group is added now the name of Robert Stone, your professor of radiology. His academic standing, like his modesty, bears the stamp of greatness.

"As Associate Director of Health for the Metallurgical Project he bore a grave responsibility with courage, competence, and silence. The work he did involved uprooting ties with home and school, much travel, no small personal danger and, above all, the discipline of everlasting secrecy.

"Robert Spencer Stone, on behalf of the Radiological Society of North America, and through it, of the radiologists of the New World, it is my privilege, as President-Elect of that Society, to bestow on you its Gold Medal.

"May I conclude with Robinson Jeffers' words:

'Lend me the stone strength of the past and I will lend you
The wings of the future, for I have them.'

"It is my fortune to call you comrade."

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The Mid-summer Conference of the Rocky Mountain Radiological Society will be held at the Shirley Savoy Hotel, Denver, Colo., August 7, 8, and 9, 1947. The program is not complete, but two of the guest speakers will be Dr. Lowell S. Goin, Los Angeles, Calif., and Dr. Leo G. Rigler, Minneapolis, Minn. There will be other guest speakers. It is suggested that radiologists plan their vacations to attend this conference.

FOURTH INTERNATIONAL CANCER RESEARCH CONGRESS

The Fourth International Cancer Research Congress, sponsored by Union Internationale Contre le Cancer and the American Association for Cancer Research, with the assistance of other organizations and individuals interested in promoting cancer research, will be held in St. Louis, Mo., Sept. 2–7, 1947, with headquarters at the Jefferson Hotel. Dr. E. V. Cowdry of the Barnard Free Skin and Cancer Hospital, St. Louis, is the Chairman of the Executive Committee; Dr. Shields Warren, Boston, of the Program Committee; and Dr. G. W. Larimore of the American Cancer Society (47 Beaver St., New York) of the Exhibits Committee. The local arrangements are in the hands of a committee headed by Dr. A. N. Arneson of the Mallinckrodt Institute of Radiology, St. Louis.

For room reservations application should be made promptly to Mr. F. H. Rein, St. Louis Publicity and Convention Bureau, 911 Locust St., St. Louis 1, Mo.

AMERICAN CONGRESS OF PHYSICAL MEDICINE

The American Congress of Physical Medicine will hold its twenty-fifth annual scientific and clinical session Sept. 2–6, inclusive, at the Hotel Radisson, Minneapolis. Scientific and clinical sessions will be given on the days of Sept. 3, 4, 5, and 6. In addition to the scientific sessions, the annual instruction courses will be held Sept. 2, 3, 4, and 5. For information concerning the convention and the instruction courses, address the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2, Ill.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to cooperate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates. Address: Howard P. Doub, M.D., The Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Courtney S. Stickley, M.D., Bell Bldg., Montgomery. Next meeting at the time and place of the Alabama State Medical Association meeting.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and annually at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, D. R. MacColl, M.D., 2007 Wilshire Blvd., Los Angeles 5.

LOS ANGELES COUNTY MEDICAL ASSOCIATION, RADIOLOGICAL SECTION. *Secretary*, Moris Horwitz, M.D., 2009 Wilshire Blvd., Los Angeles 5. Meets second Wednesday of each month at County Society Bldg.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Ivan J. Miller, M.D., 2000 Van Ness Ave. Meets monthly on the third Thursday at 7:45 P.M., January to June at Lane Hall, Stanford University Hospital, and July to December at Toland Hall, University of California Hospital.

Colorado

DENVER RADIOLOGICAL CLUB. *Secretary*, Washington C. Huyler, M.D., Mercy Hospital, 1619 Milwaukee, Denver 6. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Robert M. Lowman, M.D., Grace-New Haven Hospital, Grace Unit, New Haven. Meetings bimonthly, second Thursday.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maxey Dell, Jr., M.D., 333 West Main St., S. Gainesville.

Georgia

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert Drane, M.D., De Renne Apartments, Savannah. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, T. J. Wachowski, M.D., 310 Ellis Ave., Wheaton. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April, at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Frank S. Hussey, M.D., 250 East Superior St., Chicago 11.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, J. A. Campbell, M.D., Indiana University Hospitals, Indianapolis 7. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L. Pirkey, Louisville General Hospital, Louisville 2. Meets second Friday of each month at Louisville General Hospital.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, Harry A. Miller, M.D., 2452 Eutaw Pl., Baltimore.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D, 802 Medical Arts Bldg., Minneapolis 2. Regular meetings in the Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, O. A. Neely, M.D., 924 Sharp Building, Lincoln. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene M.D., Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary-Treasurer*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, W. H. Seward, M.D., Orange Memorial Hospital, Orange. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway, L. I.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Abraham H. Levy, M.D., 1354 Carroll St., Bklyn. 13. Meets fourth Tuesday of every month, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary-Treasurer*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings in January, May, and October.

LONG ISLAND RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Wm. Snow, M.D., 941 Park Ave., New York, 28.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary*, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO RADIOLOGICAL SOCIETY. *Secretary*, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting at annual meeting of the Ohio State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Hugh A. Baldwin, M.D., 347 E. State St., Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George L. Sackett, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

RADIOLOGICAL SOCIETY OF THE ACADEMY OF MEDICINE (Cincinnati Roentgenologists). *Secretary-Treasurer*, Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meets third Tuesday of each month.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Peter M. Russo, M.D., 230 Osler Building, Oklahoma City. Meetings three times a year.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Lester M. J. Freedman, M.D., 415 Highland Bldg., Pittsburgh 6. Meets second Wednesday of each month at 6:30 P.M., October to May, inclusive.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. M. Popma, M.D., 220 N. First St., Boise, Idaho.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frére, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month, in Dallas in the odd months and in Fort Worth in the even months.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth 4.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, M. Lowry Allen, M.D., Judge Bldg., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE. *Secretary*, Henry H. Lerner, M.D. Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, E. Latan Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Frederic E. Templeton, M.D., 324 Cobb Bldg., Seattle 1. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day meeting in May and one day at annual meeting of State Medical Society in September.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Observations on Encephalographic Findings in Cerebral Trauma. Charles E. Troland, Donald H. Baxter, and Richard Schatzki. J. Neurosurg. **3:** 390–398, September 1946.

The encephalographic findings in a series of 261 patients (177 with head injuries with skull defects, 29 with closed head injuries, 32 with idiopathic epilepsy, 23 with other lesions of the central nervous system) are reviewed. The x-ray reports were available in all instances, and the actual films were obtained for review and for special measurements in 193 cases, 159 of which were cases of head injury. Some of the clinical records were not at the authors' disposal at the time of the study. In all cases a complete series of roentgenograms, consisting of anteroposterior, postero-anterior, and both lateral stereoscopic views, was made. A description of the encephalographic technic used is included.

In the series of 261 encephalograms, satisfactory filling of the ventricles was shown in 227 (87.5 per cent), poor filling in 15 (5.5 per cent), and no filling in 19 (7 per cent). In 168 cases of all types the ventricular filling was satisfactory and the films were available for review. The encephalograms were abnormal in 117 of this group and normal in 51.

Of the 143 cases of head injury in which filling of the ventricles was satisfactory and the films and clinical records were available, 17 (12 per cent) showed a shift of the ventricular system toward the side of the cranial defect. In 12 (8.5 per cent) of the 143 cases there was symmetrical enlargement of the lateral and third ventricle. Two patients with non-traumatic epilepsy also showed this type of ventricular dilatation. It is thought that in the majority of cases this condition is due to generalized loss of cerebral substance with secondary dilatation of the cerebrospinal system. Eleven cases (8 per cent) revealed enlargement of both lateral ventricles without enlargement of the third ventricle. In 41 (29 per cent) bilateral asymmetrical enlargement of the lateral ventricles was evident; of this number, 31 (75 per cent) showed also dilatation of the third ventricle. The side of the greatest enlargement of the lateral ventricle was always the side of the injury in both open and closed head injuries. In 42 of the 143 instances (29 per cent), there was enlargement of only one lateral ventricle.

In a group of 60 patients in whom second-day study of the ventricles was made, an increase in the ventricular size on the second day was found in over one-third.

There were 126 cases of cranial trauma of both types in which the exact time of the injury was known and the encephalograms were excellent; in 33 (26 per cent) the injury had been sustained less than three months before encephalography and of these, 20 (60 per cent) showed ventricular enlargement of some type.

Of 129 cases of cranial trauma in which filling of the ventricles was satisfactory and there was adequate neurologic information, 11 (8.5 per cent) revealed a normal ventricular system in the presence of clinical evidence of definite neurological damage. In 61 (47.5 per cent), there were positive evidence of neurological damage and abnormal encephalographic findings, while 26 (20 per cent) had no clinical or encephalographic signs of cerebral damage. In 31 (24 per cent) the encephalogram was abnormal, although the neurologic examination was negative.

In 123 cases (116 patients with cranial defects, 7 closed head injuries) encephalographic filling was satisfactory and information was available as to post-traumatic symptoms. Six of the 7 patients with closed head injuries had severe post-concussion syndromes consisting of headache, dizziness, intolerance to alcohol, and some loss of memory. Four of these had normal encephalograms. Of the 116 patients with cranial defects, 47 (41 per cent) had post-traumatic symptoms (headaches, dizziness, etc.); 14 (29 per cent) of these had normal encephalograms.

Encephalography has been said by many authors to relieve post-traumatic symptoms but in this series the amount of relief was meager and minimal.

Toxoplasmic Encephalomyelitis, with the Report of Two Cases. E. Graeme Robertson. M. J. Australia **2:** 449–452, Sept. 28, 1946.

The protozoon parasite *Toxoplasma* produces various clinical manifestations, summarized by Sabin (in Advances in Pediatrics, New York, Interscience Publishers, Vol. I, 1942) as follows: (1) abnormal enlargement of the head *in utero*, the result of encephalomyelitis in the fetus; (2) encephalomyelitis of the newborn (originating *in utero*), which terminates fatally during the first days or weeks of life; (3) congenital encephalomyelitis giving rise to hydrocephalus or microcephaly, cerebral calcification, chorioretinitis, and nervous disturbances such as convulsions ("epilepsy"), spasticity, and mental deficiency observed in infancy and early childhood; (4) atypical encephalitis, with twitchings of isolated muscle groups, convulsions, disorientation, low-grade fever and pleocytosis, but thus far without the so-called "signs of meningeal irritation" (nuchal rigidity, Kernig's sign, etc.) and without signs pointing to involvement of the cranial nerves; (5) acute febrile exanthematic disease associated with atypical pneumonia; (6) a mild or inapparent infection betrayed only by the demonstration of antibodies against toxoplasma or the birth of an infant with clinically apparent toxoplasmosis.

The roentgen features in children have been described by Dyke *et al.* (Am. J. Roentgenol. **47:** 830, 1942. Abst. in Radiology **41:** 84, 1943). They consist chiefly in multiple small bilateral rounded areas of calcium density 1 to 3 mm. in diameter in the brain substance. There may be curvilinear calcium streaks in the basal ganglia. Signs of hydrocephalus or microcephaly may be evident.

The author presents two cases with many of the salient features of the disease. The first patient, a girl of thirteen, developed normally for one and one-half years and then began to show evidence of retarded mentality, unilateral microphthalmia, speech difficulty, and poor vision, which increased with advancing age. She complained of headaches, was unstable in her emotional responses, and at the age of twelve began to have convulsive seizures limited to the left side. Radiographic examination of the skull showed widely scattered areas of calcification, chiefly in the lower and outer parts of the parietal lobes, more pronounced on the right side. One small round mass was seen in the right frontal lobe. Symmetrical comma-shaped deposits were present in the region of the caudate nuclei. The

bones were thick and well marked digital impressions were seen in them. Encephalographic studies showed normal filling of the cisterna magna, the fourth ventricle and the aqueduct, but no filling of the third ventricle and the lateral ventricles. Additional air merely outlined the other basilar cisterns and the cerebral sulci, which appeared normal. Treatment with phenobarbital and "Dilantin" abolished the epileptic manifestations and improved the temperament of the child.

The second patient showed rapid enlargement of the head for four days after birth, followed by more normal development. She was lethargic when first seen, but no clinical evidence of hydrocephalus was present. The left eye was smaller than the right and the media on this side were opaque, the pupil was irregular, the cornea was clouded, and posterior synechiae were present. Choroiditis and posterior synechiae were present on the right. Roentgenograms of the skull revealed two faint crescentic areas of calcification, apparently in the region of the basal ganglia. At the age of thirteen months the cephalic circumference was 17.5 inches. The eyes were unchanged. No abnormal neurological signs were present except evidence of delayed mental development. The calcifications observed radiographically appeared more dense but of the same distribution as before.

Though there was no definite proof obtained of toxoplasmic infection in either of these cases, the author believes the clinical syndrome together with the objective findings are sufficient to establish the diagnosis.

BERNARD S. KALAYJIAN, M.D.

Optochiasmatic Arachnoiditis. Eugene P. Pendergrass and Charles R. Perryman. Am. J. Roentgenol. **56:** 279–298, September 1946.

Chiasmal inflammatory lesions produce a syndrome that is similar to that produced by a tumor in the region of the optic chiasm. Trauma and infection of the meninges and brain by syphilis, mastoiditis, sinusitis, petrositis, and chronic rhinopharyngitis have been described as etiologic factors in optochiasmatic arachnoiditis. It may be a sequel of encephalitis, multiple sclerosis, or tuberculosis. At operation the arachnoid is thickened, grayish, and opalescent. There may be single or multiple arachnoid cysts; the optic nerves and chiasm appear atrophic and are usually enmeshed in adhesions. There may be calcareous arachnoid plaques. The patient usually complains of loss of vision in one or both eyes and headache. The fundi often show optic nerve atrophy. Choked disks are seen in 10 per cent of the cases. The most common visual field defects are central scotoma, concentric contraction, and temporal loss.

If the conventional roentgenogram shows nothing abnormal, it is important for the roentgenologist to emphasize the possibilities of air encephalography. The authors describe clearly the normal appearances of the cisternae chiasmatis, interpeduncularis and pontis, and these are illustrated in the text. The carotid artery, the anterior communicating artery, and occasionally the middle cerebral artery may be outlined in the superior portion of the cisterna chiasmatis. An ovoid shadow just above the sella turcica represents the optic chiasm. The infundibulum of the hypophysis is seen more posterior.

The encephalographic findings in optochiasmatic arachnoiditis are rather typical if the cerebrospinal system is well drained of fluid, which is replaced with air through the lumbar route. The shadows of the cisternae chiasmatis and interpeduncularis can be readily demonstrated in most individuals who have no symptoms referable to that region. In the presence of optochiasmatic arachnoiditis the clear air shadows of the cisterna chiasmatis, and occasionally the cisternae interpeduncularis and pontis, are absent, deformed, or encroached upon, and the structures usually seen cannot be identified. Tumor is usually thought to be present. We now know that chiasmal arachnoiditis should always be considered in arriving at the final diagnosis.

Four cases of chiasmatic arachnoiditis, one of syphilitic origin, are presented. Pitfalls in diagnosis include errors in technic, such as incomplete drainage and examination in the horizontal posture employing a vertical beam. Lesions such as tumor in the region of the optic chiasm are shown, to illustrate the difficulty of differential diagnosis in some instances.

CLARENCE E. WEAVER, M.D.

Some Observations Concerning the Hypophysial Fossa. Gilbert W. Heublein. Am. J. Roentgenol. **56:** 299–319, September 1946.

One hundred apparently normal subjects in an army hospital gave the following measurements for the sella turcica: average anteroposterior diameter, 10.66 mm.; average depth, 8.30 mm. The largest sella measured 13 mm. (anteroposterior) by 9 mm. (depth) and the smallest 8 by 5 mm. Seven per cent of the series showed bridging of the sella. The usual contour was oval, 53 per cent; a round contour was present in 28 per cent, while in 19 per cent the sella was either oblong or flat.

The author describes and illustrates many normal variants of the sella, the clinoids, the sphenoid sinus, and the dorsum sellae. It is important that the roentgenologist be conversant with the numerous normal variants which may be encountered. Physiological calcification of the petroclinoid ligaments is a well known finding. Calcium deposits may be found within the pituitary gland and are not necessarily of clinical importance. Faint calcification above the fossa often indicates the presence of a Rathke's pouch tumor.

In the presence of a tumor, roentgen evidence usually precedes visual field involvement. Interpretation of the visual field findings usually throws some light on the severity of the damage done, and degree of improvement following irradiation and surgery, and offers, as well, a delicate means of evaluating the effectiveness of therapy. Choked disks are rarely seen with pituitary adenoma. Adenoma causes a uniform and general enlargement of the fossa, the ventral wall of the dorsum is smoothly eroded, the dorsum is often displaced posteriorly and apparently elongated. If eccentric in position, the tumor may cause erosion of the ipsolateral anterior clinoid.

Any bizarre appearance of the hypophyseal fossa, or a roentgen picture not consistent with diagnosis of adenoma, should bring to mind some form of extrasellar lesion. Pressure transmitted from above due to a dilated third ventricle may erode the posterior clinoids and the dorsum. This may be the result of tumor or stricture of the aqueduct. A nasopharyngioma is described which invaded the floor of the middle fossa in the left parasellar region. Carcinoma metastases and multiple myeloma have been known to invade the sella. Aneurysms of the circle of Willis will, if large enough, cause marked sellar deformation. Calcification in the

wall of the aneurysm is often seen on conventional roentgenograms. This must be differentiated from sclerosis without aneurysm. For accurate diagnosis the method of choice is arteriography.

CLARENCE E. WEAVER, M.D.

Roentgen Diagnosis of Clivus Chordoma. Siegfried Epple and Ernst Ruckensteiner. Schweiz. med. Wchnschr. **76:** 764–766, Aug. 17, 1946.

Clivus chordomas occur at the base of the skull and are of two types, benign and malignant. The latter do not tend to metastasize, but are characterized by cranial nerve involvement, most often of the abducens. Pressure on the brain stem may lead to pyramidal tract symptoms. Elevation of intracranial pressure is rare and occurs only late in the disease. Roentgenologic signs are few: in the benign type exostotic-like projections of bone in the region of the clivus have been described, in contrast to which the malignant type destroys the clivus. Calcification in the tumor is exceptional. Filling of the nasal space may occur, or of the retropharyngeal space with vertebral involvement. Air filling does not necessarily lead to a diagnosis, since, as Lysholm has pointed out, cerebellar tumors and clivus meningiomas produce similar pictures. The author records a case of the malignant type in a 57-year-old man, in which roentgenograms showed destruction in the base of the skull and of the tip of the epistropheus.

LEWIS G. JACOBS, M.D.

Lückenschädel in a Patient with Amnesia Amenable to Hypnotherapy: A Personality Study. Jerome M. Schneck. J. Nerv. & Ment. Dis. **104:** 249–262, September 1946.

A case of Lückenschädel in a boy of 18, with amnesia which proved amenable to hypnotherapy, is presented. This is apparently the oldest patient with this condition reported thus far and probably only the second patient discussed in the literature who has lived beyond infancy. The literature is reviewed and roentgenograms are reproduced.

Obstruction of the Nasopharynx Secondary to Choanal Polyp of Antral Origin. Report of Three Cases. David Myers. Arch. Otolaryng. **44:** 328–333, September 1946.

Three cases of choanal polyp presenting similar clinical and roentgenologic findings were encountered in a three-year period during which over twenty-five thousand otorhinologic examinations were made. The diagnosis is based on a history of severe chronic nasal obstruction, a profuse purulent nasal discharge, usually unilateral, pain referred to the maxillary region, and at times a feeling of obstruction in one or both ears, with gradual impairment of hearing. Examination reveals a large polyp, most frequently single, which projects from the middle meatus, completely filling the nasal chamber and extending into the nasal pharynx. Posterior rhinoscopy reveals a large mass in the nasopharynx. The mass is easily felt with the palpating finger. Postero-anterior roentgenograms of the sinuses show evidence of chronic inflammation in the antra, and in lateral views a large globular mass extending into the nasopharynx is seen. Pathologically this growth resembles a nasal polyp and it is usually so diagnosed. It differs from a nasal polyp, however, in that it is firmer and contains a great amount of dense fibrous connective tissue, which may be undergoing myxomatous changes.

The treatment of choice is the Caldwell-Luc operation, with removal of both the nasal and antral portions of the polyp.

Mandibular Tumors. A Clinical, Roentgenographic, and Histopathologic Study. Louis T. Byars and Bernard G. Sarnat. Surg., Gynec. & Obst. **83:** 355–363, September 1946.

The object of this paper is to demonstrate (1) that many mandibular tumors may roentgenographically resemble ameloblastomas and (2) that ameloblastomas do not have a constant characteristic roentgenographic picture. These observations are tersely exemplified by a series of 12 brief case reports with reproductions of roentgenograms and photomicrographs. Multilocular radiolucent areas in the mandible are demonstrated in ameloblastoma, multiple follicular cyst, giant-cell tumor, fibroma, fibrosarcoma, osteogenic sarcoma, and metastatic carcinoma from breast and thyroid.

A concise table is given of the characteristics of mandibular tumors which appear multilocular on the roentgenogram. It is emphasized that the histopathologic diagnosis is specific. The roentgenographic diagnosis, however, is non-specific and includes many tumors which, though radiolucent, are not truly cystic. For this reason a roentgenographic classification is given dividing tumors into those of dental and non-dental origin.

The authors emphasize that the diagnosis of ameloblastoma or any other tumor of the mandible should not be made by the roentgenogram alone. The prime value of the latter is to show the site and extent of these multilocular lesions.

ARTHUR W. PRYDE, M.D.

Radiologic Investigation and Diagnosis of Laryngeal Fractures. R. Mathey-Cornat and Pellegrino. J. de radiol. et d'électrol. **27:** 419–422, 1946.

Case histories are given to illustrate the manner in which radiologic examination may supplement direct examination to clarify diagnosis in laryngeal fractures. In one case a lateral view demonstrated a fracture of the right greater cornu of the thyroid cartilage. In another, the alae, right and left, had been fractured.

The most informative projections were the two lateral views, plain and with a Valsalva effort. Subcutaneous emphysema is usually noted. Edema of the larynx is an important complication, as is hematoma formation.

Tomography, when available, may be of great aid.

PERCY J. DELANO, M.D.

Laryngocele. Mac. D. Campbell. Arch. Otolaryng. **44:** 219–222, August 1946.

Laryngoceles have been divided into three classes: (1) internal, a cystic dilatation within the larynx; (2) superior external, a cystic dilatation of the sacculus of the ventricle of Morgagni that penetrates the thyrohyoid membrane just above the upper rim of the thyroid cartilage and anterior to the superior cornu or just lateral to the thyroid notch; (3) a combination of (1) and (2). A case of the second type is reported.

A 38-year-old soldier had a visible tumor, which rose with swallowing, in the anterior superior triangle of the left cervical region. It was soft and compressible and could be collapsed with a squealing sound when the patient's mouth was open. Indirect and direct laryn-

goscopy revealed nothing abnormal. Anteroposterior and lateral views of the cervical spine showed a cyst-like tumor, approximately 6 × 4 × 4 cm., on the left side of the neck at the level of the hyoid bone. The "tumor" was filled with air and displaced the larynx to the right. Fluoroscopy of the upper part of the esophagus after oral administration of barium failed to reveal any communication between that part of the esophagus and the "tumor." At operation a diverticulum of the larynx with active chronic mural inflammation was found.

THE CHEST

Aplasia of the Lung. W. M. Pierson. Ann. Otol., Rhin. & Laryng. **55:** 604–608, September 1946.

The diagnosis of true aplasia of the lung by roentgen examination, bronchoscopy, and bronchography in an infant of eight months appears to be sufficiently rare to justify publication. The child was first seen at the age of five months with slight dyspnea developing during the course of a head cold. X-ray examination showed a dense shadow in the lower portion of the right chest. The mediastinal structures were displaced far to the right. The cardiac shadow and the right diaphragm could not be identified. Barium was given by mouth, and the esophagus was shown to be in the right chest. All the films showed air in the upper right chest, which was attributed to hypertrophied lung tissue on the left side which had crossed over to the right side.

Bronchoscopy the following month revealed no evidence of a carina or a right bronchus. Two months later bronchography was done following the introduction of iodized oil through a tracheal catheter. The trachea was well outlined by oil, and was seen to continue downward into what appeared to be the left main stem bronchus, which also filled with oil. No bifurcation of the trachea was demonstrable. The obvious diagnosis was absence of the right main bronchus and lung.

Absence of a lung does not necessarily forecast an early death, as cases have been reported in patients aged 58, 65, and 72 years, all whom died of causes unrelated to the anomaly. Symptoms in many cases are absent, the condition being discovered only by accident. Dyspnea, cyanosis, and a failure to thrive may be noted in the very young. The external symmetry of the thorax is maintained in most cases. The heart and the mediastinal contents are displaced to the affected side and the apical impulse of the heart is pronounced. Dullness or flatness on the affected side is common. Resonance may be present due to the hypertrophy and emphysema of the remaining lung. Breath sounds may be absent or suppressed. The usual roentgen interpretation is massive or fetal atelectasis.

STEPHEN N. TAGER, M.D.

Agenesis of the Right Lung with Death Following Aspiration of Foreign Bodies into the Left Lung. Horace E. Mitchell. Ann. Otol., Rhin., & Laryng. **55:** 609–616, September 1946.

It seems probable that a total of more than 80, possibly nearly 100, cases of agenesis of one lung have been reported in the literature. At least one case of absence of both lungs has been observed (Gruenfeld and Gray: Arch. Path. **31:** 392, 1941). A paralysis of the diaphragm on one side and diaphragmatic hernia may present similar clinical and roentgen findings, but tomography, bronchoscopy, and roentgenologic study following introduction of lipiodol into the tracheobronchial tree should yield sufficient information to make a correct diagnosis. Bronchoscopy is the most important feature of a complete examination. The bronchoscopic findings vary. In some cases there is a bronchus or rudimentary bronchus on the side on which the lung is absent; in others there is no such rudiment. If a bronchus is present, as a rule no opening can be visualized.

The cause of agenesis of the lung is not definitely known. Disagreement exists among embryologists and anatomists as to whether the defect is present in the original germ plasm or is a result of some disturbance occurring early in the development of the embryo.

The case here reported was published previously as one of a series of cases of foreign bodies in the air and food passages (Ohio State M. J. **32:** 950, 1936). A two-year-old child stumbled and fell, aspirating some partially masticated peanuts and chewing gum into the tracheobronchial tree. Dyspnea and cyanosis immediately followed, and death occurred about twenty minutes later, before an examination could be made. At autopsy, the left lung was found to be hypertrophied, filling the left side of the chest and extending beyond the mid-line. The right lung was completely absent, with the bronchus ending blindly. A section through the stump showed nothing but cartilage. No rudimentary right lung tissue nor vessels were found. When the left bronchus was opened, two foreign bodies, consisting of masticated masses of chewing gum and peanuts, were found. STEPHEN N. TAGER, M.D.

Observations on Mass X-Ray Surveys. Waldo R. Oechsli. Calif. Med. **65:** Tuberculosis Supplement, pp. 29–31, August 1946.

Lack of equipment and personnel stands in the way of the realization of the goal of the Public Health Service, which is that every person in the United States should have a chest x-ray examination. There is, however, one method of case finding which can be more readily put into effect that should yield a considerable number of cases, namely the routine examination of all patients entering general hospitals. Protection of hospital personnel should in itself justify such a program. Statistics from one large university have shown that student nurses on a general hospital service have 100 times the chance of acquiring tuberculosis as students in the school of education. The author stresses the importance of the 14 × 17-inch film for making an actual diagnosis after the miniature film has been studied.

A special warning is issued against the dangers of excessive irradiation of personnel engaged in photofluorographic surveys. Dangers due to technical miscalculations, such as too high insertion of the lead-glass window in the screen or inadequate lighting over the patient, can be avoided by attention to these details.

MAURICE D. SACHS, M.D.

Putting Miniature Films to Work—Follow-up by Health Department. W. G. Winter. Calif. Med. **65:** Tuberculosis Supplement, pp. 31–33, August 1946.

The author feels that too great emphasis has been placed upon mass chest x-ray surveys without sufficient consideration of the tuberculous patient's care once he has been discovered. It is strongly felt that no

survey should be undertaken until there has been adequate planning for each step in the process.

One of the first steps is the notification of the negative group, which he believes should include such minor findings as abnormal ribs, slight pleural thickening, and calcifications. For this he recommends the notification form used by the U. S. Public Health Service, reading: "On the date shown below, an x-ray was taken of your chest. You will be glad to know that the condition of your lungs appears satisfactory on this x-ray film." About 95 per cent of the group surveyed will receive such notification. Contact with the positive group may be by letter or by the public health nurse. One voluntary organization found that 40 per cent of those approached only by letter responded and were re-examined, but that this figure rose to 63 per cent when a visit from the public health nurse was added.

A special plea is made for protection of the patient's economic interests and for the maintenance of the private practitioner-patient relationship.

MAURICE D. SACHS, M.D.

Pulmonary Cavitation, Difficulty in Differential Diagnosis by X-Ray. Norman Diamond. Dis. of Chest **12:** 422–430, September-October 1946.

Cavitation in the lung, with whatever disease it is associated, represents an identical pathological process, namely, destruction of the parenchyma with resultant interruption of the pulmonary framework. The excavations assume a given shape or appearance as a result of elastic retraction of surrounding lung tissue, partial bronchial occlusion, and marginal atelectasis of the surrounding alveoli. The roentgenographic appearance of a cavity, with or without a fluid level, is nothing more than a high-light. The identification of the specific etiology of the destructive lesion becomes then a clinical problem; to require the roentgenologist to give a precise diagnosis without a clinical work up is to place him in an unfair position. While the author believes that in the final diagnosis most of the emphasis should be placed on the clinical aspects, this does not minimize the value of the roentgen study, for it is admitted that most cavities would be missed if left solely to clinical and physical examination.

A table is presented listing diseases with cavitations and their characteristics, and roentgenograms are reproduced to show the similarity of the appearances in examples due to different causes.

HENRY K. TAYLOR, M.D.

Appearance of Reinfection Tuberculosis in Children. José Rodríguez Betancourt, Miguel A. Valiente, Carlos Amador, and Pedro G. Hoyos. Bol. Soc. cubana de pediat. **17:** 131–146, April 1945.

The most frequent type of reinfection tuberculosis in childhood is the so-called secondary or post-primary infiltration, due to a reactivation of residual foci of disease. Among 2,100 cases of active tuberculosis in children studied by the authors, about 300 (14 per cent) were of this type, while only 41 examples (2 per cent) of tertiary infiltrates were observed. The clinical picture varies, ranging from complete absence of symptoms to an acute condition with fever and signs of consolidation. Hemoptysis was never observed by the authors in this group.

The perihilar region is the usual site of the secondary lesions, though there may be involvement of other parts of the lungs, especially the bases. The infiltrate may assume a triangular form or may appear as a transverse band or a mass invading one or more lobules. The appearance is homogeneous.

The usual course is benign, with healing in one or two years. Relapses occurred in some of the authors' cases but in these, too, healing eventually followed. In some few cases caseation ensues, with eventual cavitation. Under such conditions the symptomatology is obvious, the shadow lacks homogeneity, and the patient grows progressively weaker. Other manifestations of the secondary process may appear at the same time as the pulmonary lesions; pleurisy, peripheral adenopathy, phlyctenular conjunctivitis, tuberculous peritonitis, etc.

The tertiary type of the disease, seen in older patients, represents a new focus, in a previously sound lung or at the site of an earlier lesion. Since the clinical picture is not always clearly defined, radiologic examination and other auxiliary methods of diagnosis are of special importance. About a third of the cases are of acute onset with high fever and respiratory symptoms. The infraclavicular region is the usual site of the lesion in the beginning. Radiologically it appears as a rounded or oval shadow, about 2 cm. in diameter, of moderate density, more intense at the borders. Caseation, cavitation, and dissemination are of frequent occurrence. On the other hand, healing may take place or the disease may remain stationary for a considerable time. There may or may not be an associated osteoarticular tuberculosis.

The differential diagnosis between early infiltrations and secondary infiltrations is difficult if the patient's history is unknown or there has been no previous tuberculin test. Sometimes films will show traces of the early infection surrounded by the secondary infiltration, but it is frequently impossible to determine whether one is dealing with a late primary infection or an early secondary one. Differentiation of the tertiary infiltration is in general easier. The greater age of the patient, history of exposure and of an earlier positive tuberculin test, the site of the lesion, the calcified primary complex, the rapid evolution toward caseation with demonstration of the tubercle bacillus in the sputum are factors of great value. Even in these cases, however, differentiation is sometimes impossible, and the true condition is revealed only at necropsy. VICTOR GIANNONI, M.D.

Sarcoidosis—A Manifestation of Tuberculosis. Charles Cameron and E. K. Dawson. Edinburgh M. J. **53:** 465–484, September 1946.

A case of pulmonary tuberculosis with pathological changes in other tissues conforming to the accepted clinical and histologic features of sarcoidosis is reported. The history is given in detail and covers a period of almost fifteen years—from the time of the initial disturbance, when the patient was five years old, until her death at nineteen and a half. A diagnosis of pulmonary tuberculosis was first made at eight years of age, though an increased hilar shadow had been present three years earlier, when the patient first came under observation for a rheumatic condition. After the age of eight she had a persistent cough, and by fourteen years the lung picture suggested a chronic fibrotic type of tuberculosis. The roentgen appearance was that of a chronic fibrotic tuberculous lesion of the right upper lobe, with diffuse abnormal shadows in both lungs of the sarcoidosis type. Such shadows resemble closely those of chronic miliary tuberculosis, especially

of the lymphogenous type, and the differentiation of the two conditions is often a matter of personal opinion. Skin lesions, resembling bruises, appeared on the lower limbs at the age of nine; their histologic nature was not determined at that time. When the patient was fourteen, both eyes became involved by an iridocyclitis, and at the same time a profuse culture of tubercle bacilli was obtained from the sputum. Shortly afterwards, hematuria occurred, and during the next year the liver became enlarged. Swelling of the joints, first observed at the age of six, remained unchanged, and there was a persistent albuminuria. At the age of sixteen and a half the patient had an attack of right renal pain associated with pyuria. Two months later a skin rash appeared. Tubercle bacilli were again found in culture, this time from gastric lavage. The nature of the skin condition, sarcoid in distribution (mainly limited to face and limbs), was now confirmed histologically. In addition to these localized foci of disease, there was also a systemic disturbance, manifest in underdevelopment in size and weight and the absence of secondary sexual changes. A congenital cardiac condition, apparently unrelated to the other lesions, may have been responsible for the failure of development. The patient died a cardiac death, following influenza and bronchopneumonia. Autopsy or biopsy of a joint was not permitted.

The relationship of tuberculosis and sarcoidosis is discussed at length.

Bronchiectasis Following Primary Tuberculosis. Edna M. Jones, W. M. Peck, and H. S. Willis. Am. J. Dis. Child. **72:** 296–309, September 1946.

In a study of 716 children with pulmonary tuberculosis, by Jones, Rafferty, and Willis (Am. Rev. Tuberc. **46:** 392, 1942), 85 showed in roentgenograms a dense, more or less homogeneous and usually segmental or lobar shadow that suggested obstructive pneumonitis; 42 of these were examined bronchoscopically and 31 were found to have tuberculous involvement of a bronchus in the form of ulceration, granulation tissue, tuberculoma, or extrinsic pressure from enlarged nodes. Several years later some of these children, together with others showing the same phenomenon, were studied by bronchography.

The authors obtained satisfactory bronchograms in 34 of the 37 children examined and demonstrated bronchiectasis in the area of former pneumonitis in 24 children but no bronchiectasis in 10. They used the catheter method of direct instillation of iodized poppyseed oil. Only the involved side was studied. Bronchiectasis was found in only 4 patients who had had their pulmonary lesions twelve months or less. The other 20 had been ill thirteen months or longer. The bronchography was done at a mean interval of three and a half years after roentgen clearing of the original lesion. It was concluded from these observations that the duration of the disease was important and that the damage was permanent. There was a preference for localization of the bronchiectasis in the anterolateral branch of the upper lobe bronchus and in the apical branch of the lower lobe bronchus.

These children had symptoms representing both the primary complex and obstruction and the bronchiectasis. There were few symptoms referable to clinical bronchiectasis after the clearing of the pneumonitis and tuberculosis.

Treatment suggested includes steam inhalation to thin the secretions, the judicious use of theophylline ethylenediamine, and postural drainage. When a tuberculoma, granulation tissue, or ulcer is present, bronchoscopic treatment is indicated.

PAUL W. ROMAN, M.D.

Generalized Lymphatic Carcinomatosis (Cancerous Lymphangitis) of the Lungs, with Special Reference to Miliary Carcinomatosis and the Syndrome of "Granulie Froide." C. G. Lambie and J. Collier. M. J. Australia **2:** 439–446, Sept. 28, 1946.

The presence of miliary infiltrations widely disseminated throughout the lungs but unaccompanied by the clinical evidences of miliary tuberculosis has produced the term "granuloma froide" among French physicians. The existence of subacute or chronic miliary tuberculosis has been questioned by many physicians. A similar appearance may be produced by sarcoidosis, pneumoconiosis, mycotic disease of the lungs, lymphogranulomatosis, and other etiologic agents. The author presents the details of a case in which the picture was due to a miliary carcinomatosis.

A 34-year-old woman had had repeated attacks of "cold" and "influenza" with a dry cough and pain in the back over the lower ribs. The cough and pain increased in severity, the sputum became more abundant, hemoptysis occurred, and there were progressive anemia, weakness, loss of weight, and finally respiratory embarrassment. Repeated tests showed no evidence of tuberculosis and none of the usual clinical signs of sarcoidosis was present. Bronchoscopic examination showed multiple small nodules on the mucous membrane of the trachea and left bronchus and a marked narrowing of the right bronchus for about one inch just below the origin of the upper lobe bronchus. No material could be obtained for biopsy. The narrowed area was hard, granular, irregular, and bled easily.

The radiographic appearance was believed to be characteristic of miliary tuberculosis, though the infiltrations were somewhat coarser than those ordinarily seen in that disease. Later some confluence of the shadows occurred in the right lower lobe area, and still later there developed evidence of pleural effusion on the right. Films of the spine showed erosion and anterior wedging of the eleventh dorsal vertebra, which increased during the course of the disease.

At autopsy, an extremely widespread miliary carcinomatosis was found in the lungs with the densest lesion in the right lower lobe and metastases in the ascending colon, the right ovary, the left kidney, the eleventh thoracic vertebral body, the left sixth rib, and the liver. The exact primary site was not determined, although the histology would indicate that it was probably bronchiogenic.

Acute miliary carcinomatosis usually runs a rapid course—seldom over two months from the appearance of the first symptoms. In this case the duration of the symptoms was over one year, but the course was rapidly downhill during the last four months. This is interpreted as indicating that the condition began as a bronchiogenic carcinoma of the slow-growing type, which suddenly erupted with secondary foci in the mediastinal nodes. This led to invasion of the lymphatics of both lungs with disseminated lesions in all lung fields and an aggravation of the symptoms.

Two main types of generalized lymphatic carcinomatosis of the lungs may be distinguished; a diffuse or non-granular type and a miliary (granular or nodular)

type. The first runs an acute course and is marked by a dense network of strands, with little if any evidence of granulation. The second is somewhat slower in its evolution; the network is inconspicuous, but miliary lesions are much in evidence. Transitional forms probably occur. If no obvious network is seen, and if there are no increased hilar shadows, but disseminated miliary lesions are present, a blood spread of secondary carcinoma and not generalized lymphatic carcinomatosis might be suspected. BERNARD S. KALAYJIAN, M.D.

Primary Atypical Pneumonia: A Disease of Segmental Distribution. W. E. Crysler. Am. J. Roentgenol. **56:** 324–336, September 1946.

In an earlier paper (Am. J. Roentgenol. **51:** 280, 1944. Abst. in Radiology **43:** 404, 1944) the author made the following observations on the roentgenographic findings in atypical pneumonia: The process is usually basal, but the upper fields are not immune; in the established case, as a rule, the roentgen opacity is homogeneous and translucent; early characteristics are blurring of the structural markings fanwise from the hilum; resolution is almost a complete reversal of these changes, intensification of the bronchovascular markings being the last sign to disappear. The further generalization is now made that in this form of pneumonia the infiltration is essentially segmental in type, the distribution being closely related to the zones supplied by the secondary rami of the bronchial tree. The bronchopulmonary segments of the lungs are illustrated and described. Frontal and lateral projections have been found best suited for routine localization. The lateral roentgenogram affords visualization of pulmonary fields behind the heart and below the summit of the diaphragm.

Atypical pneumonia differs sharply from lobar and lobular types in its bronchopulmonary segmental nature. This feature is unique. The predilection for the basal areas suggests that the disease results from aspiration of the infective agent to cause a descending bronchiogenic infection of the pulmonary parenchyma. That the dorsal segments of the upper lobes are not involved by atypical pneumonia is of some diagnostic significance for they are favorite sites of pulmonary tuberculosis. Recheck in ten days should be done when the latter diagnosis is suspected.

Many illustrative cases are given showing the distribution of atypical pneumonia in the various segments supplied by the secondary rami of the bronchial tree. The use of the lateral view in routine study of pulmonary disease is strongly recommended.

CLARENCE E. WEAVER, M.D.

Primary Atypical Pneumonia: A Report of 420 Cases with One Fatality During Twenty-Seven Months at Station Hospital, Camp Rucker, Alabama. Walter C. McCoy. South. M. J. **39:** 696–706, September 1946.

The author gives a detailed analysis of 420 cases of atypical pneumonia in military personnel, with the report of a single fatality. Patients were studied in regard to diagnosis on admission, symptomatology, physical findings, laboratory and x-ray studies, clinical course, complications, and treatment.

There was no appreciable correlation between the incidence of common respiratory infections and atypical pneumonia during the twenty-seven-month period covered by the report.

Despite the minimal physical findings as compared with x-ray evidence of pulmonary involvement, daily examination of the chest during the acute phase of illness showed some physical findings in 94.25 per cent of the cases studied.

Only cases with proved x-ray evidence of pneumonia are included in this study. In all but 9 cases more than one film was made; most of the cases had two to four films, and in a few six or more were taken. Initial films showed all variations from a very slight infiltration to complete consolidation of an entire lobe, often with secondary infiltration of another lobe. Atelectatic changes were frequently encountered and often residual horizontal thickenings, interpreted as "atelectatic plates" by the roentgenologist, were noted for as long as six to eight weeks after the first chest film. It was the author's policy to discharge no patient until the lungs were entirely clear on physical examination and completely cleared—or with only few slight residual changes—roentgenographically. In patients who were afebrile for two weeks, with normal blood studies, persistent slightly thickened markings or thin atelectatic plates were not considered a contraindication to full duty.

The most striking complication in the entire series was the tendency toward involvement of more than one lobe, which was noted in 41 cases (9.7 per cent). The lobes most commonly involved were the lower ones, either singly or in combination, followed in order by the right upper, the right middle, and the left upper lobe. There were all types of combinations, including both upper lobes, the entire right lung (2 cases), and the entire left lung (1 case). The most extensive involvement noted was in the one fatal case in which all lobes except the left upper were involved. In one case infiltration was limited to the azygos lobe.

In the majority of cases the lungs had cleared both clinically and roentgenographically within three weeks. In 13 instances clearing required more than five weeks. Complications, usually mild in this group, included extension of the pneumonic process, pleural involvement, and delayed resolution.

The treatment of atypical pneumonia is symptomatic. Sulfonamides are valueless. In the more severely ill patients oxygen and transfusions are helpful. In the treatment of complicated cases, penicillin deserves further evaluation. BERT H. MALONE, M.D.

Miliary Pneumonia of a Peculiarly Severe Course (Miliary Virus Pneumonia). W. Löffler and S. Moeschlin. Schweiz. med. Wchnschr. **76:** 815–818, Sept. 7, 1946.

The author describes a new clinical form of virus pneumonia which he terms "miliary virus pneumonia." It is characterized by a severe, often fatal course, deep cyanosis and dyspnea, with a lung picture of miliary to nodular infiltration. Seven case histories are presented.

The onset was usually acute, with a more or less nonspecific prodromal stage. In 3 of 4 cases studied, the blood showed typical cold agglutinins. The picture can be mistaken for a miliary tuberculosis. In the 4 fatal cases necropsy showed a miliary bronchopneumonia with bronchiolitis obliterans. The therapy employed was intensive use of sulfonamides and penicillin. The importance of the condition lies in its differentiation from the roentgenologically similar miliary tuberculosis, and in the fact that the cold agglutinins may agglutinate the red cells at room temperature, leading to false blood grouping reactions.

LEWIS G. JACOBS, M.D.

Q Fever in the Mediterranean Area: Report of Its Occurrence in Allied Troops. Clinical Features of the Disease. Frederick C. Robbins and Charles A. Ragan. Am. J. Hygiene **44:** 6–22, July 1946.

Epidemics of Q Fever Among Troops Returning from Italy in the Spring of 1945. Clinical Aspects of the Epidemic at Camp Patrick Henry, Virginia. Marcus Feinstein, Raymond Yesner, and Jerome L. Marks. Ibid., pp. 72–87.

A Laboratory Outbreak of Q Fever Caused by the Balkan Grippe Strain of Rickettsia burneti. Commission on Acute Respiratory Diseases. Ibid., pp. 123–157.

The three papers listed above are included in an extensive symposium on Q fever, occupying an entire issue of the *American Journal of Hygiene* and covering in great detail the clinical, epidemiologic, and etiological features.

Q fever is a rickettsial infection originally reported from Australia (1935) and occurring epidemically and endemically in the Mediterranean area and sporadically in Panama during the latter part of World War II. A significant feature of the disease is pulmonary infiltration demonstrable roentgenographically, and a diagnosis of atypical pneumonia has not been uncommon, through certain clinical, epidemiological, and laboratory findings do not wholly correspond with those in the latter disease.

Robbins and Ragan in their account of Q fever as it was observed among the troops in Italy describe the roentgen findings as consisting in patchy areas of pneumonic consolidation of homogeneous, ground-glass appearance, usually involving only a small portion of a lobe. Some collapse of lung tissue with shift of the interlobar septum was common. The majority of the cases showed single lesions but occasionally two lobes were involved. There did not appear to be any correlation between the severity of the disease and the degree of pulmonary involvement. The roentgen changes tended to be persistent and of one group of 33 patients who were carefully followed, only 6 had negative films on discharge from the hospital (average period of hospitalization for this group 22 days).

The most common clinical features in the Italian outbreak were an abrupt onset with chilly sensations and malaise, high fever of four to fifteen days' duration, frontal headache, anorexia, minimal physical signs, and fairly rapid convalescence. The diagnosis was established by isolation of the rickettsiae in guinea-pigs and demonstration of the development of specific antibodies in the blood of convalescents by means of complement-fixation and agglutination tests.

The epidemic at Camp Patrick Henry, Virginia, reported by Feinstein, Yesner, and Marks, occurred among troops recently returned from Italy and is considered to be a part of the large Italian epidemic. The outstanding characteristic of the disease as seen here was the roentgen picture, and this the authors describe in detail. To determine the distribution of the lesions they divided each lung into three zones, upper, middle, and lower. Lesions were present in the upper zones in approximately 10 per cent of the patients, in the mid-zones in approximately 40 per cent, and in the lower lung fields in approximately 50 per cent. They were evenly divided between right and left lung fields. Of special interest is the fact that more than 60 per cent of the patients had lesions which involved more than one zone, and in 25 per cent of the patients at least 3 or more zones were involved. This distribution of lesions, or at least their multiplicity, is felt to be one of the distinctive findings in Q fever in contrast to cases of primary atypical pneumonia as they are seen in military populations.

The lesions were of three types, described as follows: "(*a*) Bronchitic type, which includes lesions at the lung roots, enlargement of perihilar nodes, and abnormally increased bronchovascular markings. (*b*) Peribronchitic type, which includes lesions, frequently in the outer two-thirds of the lung fields, of the type usually associated with primary atypical pneumonia.... (*c*) Alveolar type, which includes lesions, usually in the outer one-third of the lung field, that were clearly circumscribed in character, and of rather uniform "ground-glass" density with peribronchial markings not being visible in the central portion of the lesion. In addition to the three types of parenchymal infiltration, pleuritic involvement was indicated by thickened pleural shadows and prominent fissures." The majority of the lesions were alveolar or peribroncho-alveolar in character. Evidence of pleural involvement was found in 10 cases.

In the laboratory outbreak described from Fort Bragg, 16 cases occurred. Fourteen of the patients exhibited roentgen evidence of pneumonia and in 2 subjects there were also signs of pleural fluid. As in the other series reported, lower lobe involvement predominated. The earliest lesions appeared in the peripheral portions of the lung. They tended to be circular in shape and had the appearance of ground glass. The center of the lesion was denser than the periphery. The lesion increased in size by extension and usually remained circular except where demarcated by the interlobar fissures. The hilar region was singularly free of involvement. The maximum infiltration was usually visualized between the sixth and tenth day of the illness, which was about the time that the temperature became normal. In patients with multiple areas of pneumonia, some lesions were regressing while others were developing. The pneumonic process regressed slowly, the involved area clearing in a centripetal fashion.

Delayed Chemical Pneumonitis Occurring in Workers Exposed to Beryllium Compounds. Harriet L. Hardy and Irving R. Tabershaw. J. Indust. Hyg. & Toxicol. **28:** 197–211, September 1946.

Seventeen cases of a delayed chemical pneumonitis occurring in employees of a concern manufacturing fluorescent lamps are presented. All 17 workers (3 men, 14 women) were employed in one building during the same period of time. Evidence from the literature suggests that in some unknown manner the fluorescent powders which contain beryllium compounds are of etiologic importance. No other condition or substance which is known to cause pulmonary symptoms had been discovered in the common working environment of these 17 patients. At the time of the report, 6 patients had died, 6 were gradually improving though still under medical care, one was completely well, one acutely ill, and the other 3 still seriously disabled.

The disease is of unusual interest because of its clinical features—delayed onset, intense dyspnea, weight loss, and poor prognosis. In 4 cases symptoms developed while the patients were still at work after a long period of employment in the common environment; in a second group symptoms developed between three and eighteen months after cessation of employment, and a third group first complained between two and three years after discontinuing work.

A review of the chest films in these cases of delayed chemical pneumonitis showed that the roentgenologic appearances fall into three distinct stages, not counting the variable latent period (3 months to 3 years) in which the lungs appear normal.

Stage 1: The earliest recognizable variation from the normal is a diffuse granularity, presenting a fine sandpaper appearance, which under magnification suggests a sandstorm. There are no increased linear markings, no nodules, no coalescent lesions, no pleural thickening, and no pleural effusion. The appearance is not the smooth homogeneous ground-glass appearance of pulmonary edema or consolidation, but distinctly particulate in appearance. It is uniform and diffuse, extending to the periphery and including the apices, although at first glance the latter regions seem to be spared. The hilar vascular shadows are usually normal and distinct in this stage.

Stage 2: The second stage is characterized by a diffuse reticular pattern on the granular background. The hilar vascular shadows become fuzzy and indistinct and slightly enlarged. Only three patients showed enlarged hilar nodes, moderate in degree in two instances, rather marked in one.

Stage 3: Distinct nodules appear uniformly through the lungs, varying from 1 to 5 mm. in diameter, and the appearance now resembles a snow storm. Several cases in this stage have shown multiple small dark areas between the reticulonodular shadows, giving an appearance on a single film resembling the cut surface of a sponge. These could be due to small areas of emphysema. The nodules are evenly distributed throughout both lungs. They do not coalesce, do not calcify or cavitate, and there is no definite linear fibrosis. The hilar shadows are quite fuzzy and indistinct, probably due, at least in part, to surrounding and overlapping nodulation. Pleural effusions are still absent, but the heart shadows in this stage become slightly larger and the pulmonary artery may be quite prominent. No basal emphysema is demonstrable, although one patient's films showed progressive upward displacement of the hila and the interlobar fissure on the right side.

The terminal picture may be complicated by heart failure (pulmonary congestion, hydrothorax, and cardiac dilatation), but no films were seen in this stage.

One patient apparently did not go beyond Stage 1, then showed subsequent clearing, but did not return to normal; the granular appearance is still recognizable. One other patient improved roentgenologically after reaching Stage 3 (early); the hilar shadows remain enlarged, and the lung markings are definitely exaggerated, but the nodularity and the granularity have disappeared.

The roentgen appearance in the third stage may be closely simulated by sarcoidosis or lymphangiectatic carcinomatosis, or an occasional case of erythema nodosum with marked pulmonary changes. It is less closely simulated by acute silicosis, miliary tuberculosis, a rare case of diffuse fungus infection, and occasionally by the diffuse pneumonitis and miliary atelectasis which may follow an acute virus infection.

The cardiac changes were obviously pre-existent or secondary to the increase in pressure in the pulmonary circulation. One would have expected cyanosis to be reported more constantly. The presence of clubbing in the extremities in only two cases is hard to understand.

Pulmonary Actinomycosis (Report of the First Case Observed in the Isthmus of Panama). Carlos Calero. Dis. of Chest **12:** 402–408, September-October 1946.

A 12-year-old native white girl first came under observation in December 1944 with a diagnosis of pleuropulmonary fistulae. A year earlier she had sustained severe trauma to the left hemithorax which resulted in hospitalization and subsequent surgical drainage for empyema. Repeated sputum examinations were negative. No improvement followed several courses of sulfa drugs and penicillin. Seven months later the patient was again seen, with three new fistulae. She had lost weight, and cough and morning expectoration were worse. The liver and spleen were enlarged, and there were enlarged nodes in the axillary and precervical regions, movable and not tender. Six fistulous openings were observed in the posterior thoracic wall.

A roentgenographic examination of the spine was negative. There were no evidences of an osteomyelitis of any of the ribs. Chest studies made on the original admission revealed a consolidation of the right lower lobe with a tracheobronchial adenopathy. Six months later there was a partial resolution of the lesion in the right base, but pleural thickening on the left side, with an area of consolidation in the left base.

Examination of pus obtained from fistulae revealed the characteristic ray fungus, which subsequently was found in the sputum. Following the establishment of the diagnosis, the patient was treated with penicillin, thiamine, ascorbic acid, ferrous sulfate, a diet rich in iron and calories, rest in bed, local cleansing, and sterile dressings. After seventy-three days she left the hospital apparently cured. She had gained weight, had no cough or expectoration, and the sinus tracts had closed.

HENRY K. TAYLOR, M.D.

Pulmonary Coccidioidomycosis. H. E. Bass, S. I. Kooperstein, M. M. Friedman, and G. H. Kastlin. Dis. of Chest **12:** 371–383, September-October 1946.

Human infection with *Coccidioides immitis* may be seen either as an initial infection (primary pulmonary coccidiodomycosis) or as a disseminated process (coccidioidal granuloma). The latter form apparently represents a lymphohematogenous dissemination of the primary infection to the lymph nodes, skin, bones, brain, lungs, liver, spleen, and other organs.

Most of the initial infections are asymptomatic. When symptoms do occur, the onset is abrupt, resembling an acute respiratory infection with chest pain, cough, expectoration, chills, fever, malaise, anorexia, joint pains, and headache. Skin eruptions appear in 2 to 5 per cent of the patients, usually in the form of erythema nodosum, one to two weeks after the onset. The diagnosis is based on (1) history of exposure in an endemic area, (2) roentgen findings, (3) recovery of spherules of *Coccidioides immitis* in sputum or gastric contents and confirmation by animal inoculation, (4) a positive skin test, (5) positive serological tests, (6) increased sedimentation rate, and (7) eosinophilia.

The early roentgen picture resembles an atypical or bacterial pneumonia; it may be lobular or lobar in extent with single or multiple lesions, located at the hilum or at the periphery. Enlarged hilar nodes may be present. Resolution takes place in one to three weeks. A pleural effusion may accompany and obscure the underlying process. During resolution, well circum-

scribed nodular densities may appear, which ultimately may break down and form cavities.

Resolution may be complete and leave no traces in the roentgenogram, or healing may terminate with fibrosis. Serial roentgen studies have revealed the progressive changes with resolution as follows: the initial parenchymal lesion, enlarged hilar lymph nodes, nodular lesions, excavation, and complete healing with or without fibrotic changes. Residual nodular lesions may persist for months or years. During the resolution phase the lesion may have a honeycomb appearance. Sometimes calcification occurs. The initial pneumonitis of primary pulmonary coccidioidomycosis may be difficult to distinguish from primary tuberculosis, especially when accompanied by hilar adenopathy.

The pulmonary appearance of the disseminated form may resemble carcinoma of the lung, other fungus infections, sarcoidosis, or miliary tuberculosis.

HENRY K. TAYLOR, M.D.

Löffler's Syndrome Associated with Creeping Eruption (Cutaneous Helminthiasis). Report of Twenty-Six Cases. D. O. Wright and Edwin M. Gold. Arch. Int. Med. **78:** 303–312, September 1946.

The authors recently (J. A. M. A. **128:** 1082, 1945. Abst. in Radiology **46:** 614, 1946) reported 9 cases in which Löffler's syndrome complicated creeping eruption (cutaneous helminthiasis). They now present 17 more cases in which the two conditions were associated, making a total of 26 cases of Löffler's syndrome among 76 cases of creeping eruption. This series is reported (1) to establish creeping eruption as an additional etiologic factor in the production of so-called Löffler's syndrome, (2) to prove that creeping eruption is not always a localized cutaneous disease, and (3) to forge an additional link in the chain of circumstantial evidence that Löffler's syndrome is allergic in origin.

Nontraumatic Spontaneous Pneumothorax Among Military Personnel. Samuel Cohen and J. Murray Kinsman. New England J. Med. **235:** 461–467, Sept. 26, 1946.

This is a report of 39 cases of non-traumatic spontaneous pneumothorax developing during military service. The complaints of these patients were chiefly shortness of breath (more subjective than objective) and pain in the chest radiating to the shoulder, neck, or abdomen. In a lesser number of patients cough, cyanosis, and fever were noted. In 59 per cent of the series the condition occurred while the patient was at rest, in 26 per cent during mild exertion, and in 13 per cent during active physical exertion.

Roentgen study revealed the pneumothorax more adequately than any other type of examination; the best demonstration was in forced expiration. Active pulmonary tuberculosis was seen in 2 patients, who were therefore excluded from this study; inactive tuberculosis of a minimal degree was found in 3 cases or 8 per cent; pulmonary calcifications were seen in 10 per cent. No pulmonary process could be demonstrated in the remaining 77 per cent. The collapse was considered mild in 51 per cent of the patients, moderate in 26 per cent, and severe in 23 per cent.

In considering the etiology of spontaneous pneumothorax, tuberculosis must be considered first. The tearing of adhesions is given as a second cause. A general cystic disease of the lung may cause air to flow into the pleural cavity, as may also rupture of subpleural emphysematous blebs or rupture of an interstitial emphysematous bleb.

The treatment of these patients is considered and their military disposition discussed.

JOHN B. MCANENY, M.D.

Case of Spontaneous Pneumothorax in the Newborn. Angelberto de los Heros, Gustavo Cardelle, and Reinaldo Martin Jiménez. Bol. Soc. cubana de pediat. **17:** 185–193, May 1945.

The authors present a case of spontaneous pneumothorax in a newborn infant presumably due to rough attempts at resuscitation and stress the danger of such maneuvers by persons of little experience. Radiologic studies in all cases of dyspnea and cyanosis in the newborn are recommended as the best method of reaching a diagnosis. VICTOR GIANNONI, M.D.

Spontaneous Hemopneumothorax. A Case Report. Ray Vander Meer. Am. Rev. Tuberc. **54:** 283–286, September 1946.

The author reports a case of spontaneous hemopneumothorax occurring suddenly in a 26-year-old soldier. The patient gave a history of severe left chest pain, marked dyspnea, and cyanosis developing while he was filling in a slit trench. Within twenty minutes he appeared to be in "shock" but responded well to intravenous fluids, oxygen, and morphine. A chest roentgenogram revealed fluid and pneumothorax in the left pleural cavity and diagnostic thoracentesis on the ninth day yielded pure blood which failed to clot. All blood appeared to have been absorbed by the twenty-fifth day and recovery was uneventful. Approximately 60 cases of spontaneous hemopneumothorax have been reported since 1900. Most authors agree that the bloody fluid obtained on aspiration will not clot. The reason for this is not clear. Conservative treatment is advised. L. W. PAUL, M.D.

Secondary Heart Tumor Diagnosed at Operation. Lorenzo H. Martiarena. Rev. argent. de cardiol. **12:** 13–25, March-April 1945.

A case of secondary heart tumor with clinical signs of cardiac involvement, diagnosed as a constrictive pericarditis, is reported. Roentgen examination of the chest did not show parenchymatous alterations. At operation, however, a tumor of bronchial origin was found, hidden by a shadow of right pleural effusion, with strong adhesions between lung and diaphragm preventing the liberation of the heart. Postmortem study revealed a tumor of the right lung, which had invaded the right auricle and part of the left. The diagnosis was carcinoma of bronchial origin.

THE DIGESTIVE SYSTEM

Danger Moments (Perforation, Hemorrhage) in the Roentgen Examination of the Digestive Tract. Jean-Marc Strasser. Schweiz. med. Wchnschr. **76:** 705–708, Aug. 3, 1946.

The author reports 7 cases of acute perforation of the stomach or bowel occurring in association with, and presumably as a result of, barium examination. Five of the patients died with a generalized peritonitis; one patient recovered in spite of peritonitis, and one, in whom an actual film record of the perforation was ob-

tained (reproduced in the article), recovered because the perforation took place into the pancreas and failed to soil the peritoneal cavity. The high mortality rate in spite of prompt surgical treatment is ascribed to the presence of barium sulfate in the extravasated matter. In addition, 3 cases of acute hemorrhage as a result of barium meals are described. LEWIS G. JACOBS, M.D.

Peptic Ulcer of the Esophagus. Report of a Patient with a Ten Year Follow-up. D. R. Morton and A. Brunschwig. Gastroenterology **7:** 314–319, September 1946.

The authors present a case of peptic ulcer of the esophagus in a 65-year-old woman, first seen in 1935, when she complained of vomiting after every meal and a weight loss of forty-five pounds. Roentgen examination suggested a scirrhous carcinoma of the esophagus. A cholecystectomy and a Pezzer catheter gastrostomy were carried out. On three occasions during the next six months, esophagoscopy with biopsy was performed. All three examinations showed a narrowing to 4 mm. of the mid-portion of the esophagus. All gave the impression of carcinoma, but the three biopsies revealed chronic ulceration. Other than having to return every six months for replacement of the Pezzer catheter because of erosion by gastric juice, the patient enjoyed excellent health, gained weight, and gradually was able to take a pint of milk and one soft-boiled egg by mouth each day. The main part of her nourishment was taken through the gastrostomy catheter. Roentgenography in November 1937 showed almost complete occlusion of the esophageal lumen. The patient was not seen again until November 1945. For the previous five months she had been having intermittent attacks of vomiting. Roentgen studies performed elsewhere were said to show "advanced carcinoma of the terminal esophagus and the pylorus." Repeat roentgen examination by the authors revealed no change in the esophageal lesion except less irregularity of the lumen in the constricted segment and a crater 3 mm. in diameter in the duodenal bulb. On esophagoscopy the esophagus was found to be normal to within 2 cm. of the constricted area. The posterior wall at this point was red. Anteriorly there was a "tough rim" (fibrous) which narrowed the lumen and prevented passage of the instrument. The No. 15 and 20 bougies were passed, the former without resistance. The patient was treated with parenteral fluids, vitamins, phenobarbital, and tincture of belladonna. Gradually she was placed on milk and cream by gastrostomy catheter and rapidly showed improvement, being discharged in a few weeks in good general condition. It is thought that the active duodenal ulcer might be associated with the presence of the Pezzer catheter in the stomach for ten years.

Perforation of the Esophagus Not Caused by Instrumentation. Review of Eight Cases. C. W. Engler. Ann. Otol., Rhin. & Laryng. **55:** 667–680, September 1946.

Perforation of the esophagus is of relatively rare occurrence. It is always a potentially serious condition requiring superior judgment and skill in management. Although cancer is generally cited as the most common cause, it was responsible for none of the 8 cases here recorded. Six of these were due to ingested foreign bodies, one to a caustic burn (ingested lye), and one to syphilis; in the two latter instances a broncho-esophageal fistula was formed.

Of the 6 patients with perforations caused by foreign bodies, 2 were treated conservatively and experienced spontaneous recoveries; the other four were subjected to mediastinotomy, with recovery in three and death from a fulminating paraesophageal infection after removal of the foreign body (a denture) in the other. Both patients with broncho-esophageal fistula died, the first by suicide after discharge from the hospital, and the other from the disease.

In all cases, roentgenographic examinations and endoscopy were important in establishing the diagnosis. Characteristic roentgen changes have been listed (McGibbon and Mather. Lancet **2:** 593, 1935) as follows: (1) a bubble of air or gas surrounding the point of a perforating foreign body in the cervical region; (2) forward or lateral displacement of the esophagus; (3) increase in depth of the space between the bodies of the cervical vertebrae and the trachea; (4) widening of the mediastinal shadow in the anteroposterior view; (5) passage of barium from the esophagus into the tracheobronchial system; (6) opaque medium outside the esophagus. All these findings were clearly demonstrated in this series. STEPHEN N. TAGER, M.D.

Peptic Ulcer: A Roentgenological, Laboratory, and Clinical Follow-up of 200 Peptic Ulcers. A. J. Delario. Am. J. Digest. Dis. **13:** 260–270, August 1946.

The incidence of peptic ulcer varies greatly in various countries. Climate, occupation, food habits, and hereditary influences may all be causative factors. It is well known that individuals inherit certain tendencies or weaknesses which under stress will make themselves manifest. The weakness commonly encountered in peptic ulcer patients is usually associated with the hyposthenic type of body. The low-lying stomach empties poorly and allows for accumulation of gastric contents, and its position may inhibit proper blood supply. These factors may be precursors of peptic ulcers.

A thorough study of 200 peptic ulcers (in 185 patients) was made by the author. In this series 19 were gastric, 156 duodenal, 14 parapyloric, and 11 gastrojejunal. The patients represented 16 races, of which the Irish were first with 43 cases, the Italian and English second and third with 35 and 34 cases, respectively. There were 5 males to 1 female. A high percentage of the patients (76.2 per cent) were of the hyposthenic type. The age varied from ten to seventy, but the condition occurred most commonly between the twentieth and fiftieth year. There was an increase in the hydrochloric acid content of the stomach in almost all cases, the acidity decreasing as the ulcer improved.

There are two theories as to the cause of pain in peptic ulcer. The first is that the increase in hydrochloric acid irritates the nerves in the ulcer. The second theory is that pain is produced by the increased tonicity and hyperperistalsis of the stomach. Against the theory of increased hydrochloric acid as the cause of pain the author cites the fact that the 9 patients with subacidity in his series had as much pain as those with hyperacidity, that administration of hydrochloric acid by mouth sometimes relieved pain, and that experimentally one can apply hydrochloric acid direct to the ulcer without producing pain. He believes that a patient will have pain from an ulcer only when its base is attached to the muscle or submucosa.

Seventy-two operations were performed on the 185 patients: 51 were done because of the ulcer; 21 were listed as miscellaneous, and of this latter group, 11 were appendectomies.

After years of treatment, 20 of the 185 patients, even though they showed deformed caps, were found not to have duodenal ulcers. The chief cause of missed diagnosis was peritoneal adhesions (6 cases). Chronic cholecystitis was responsible for the deformity in 4 cases.

There were only 5 patients who did not complain of pain. Those that had pain waited an average of eight and a half years after the prodromal symptoms were noted before having x-ray examination.

The length of time it took for an ulcer to heal under constant treatment of one type or another averaged sixteen months; the shortest time was two months; the longest time was forty months.

No matter how long the ulcer has existed, the fact that the patient has been adequately treated reduces the chance of perforation or the necessity of surgery: 28 per cent of those who were haphazardly treated showed perforation, died, or required surgery, whereas only 2.7 per cent of those adequately treated met with these accidents.

There were 19 gastric ulcers in the series, 9 of which were associated with duodenal ulcers. Gastric ulcers as a rule could be cured in from four to eight weeks. The author does not believe that surgery should be employed in the treatment of gastric ulcer. He cites 77 cases followed by Brown to prove that they do not become carcinomatous. Only one of Brown's patients died of carcinoma, and this was in the healed scar of an ulcer.

There were 15 perforations in the series, with 3 deaths. One patient lived without operation. The author believes the method of suturing a perforation is wrong. In the hasty effort to save the patient's life the edges of the ulcer are sutured; this reconstructs the ulcer. The ulcer edges should always be excised if possible.

Obstruction is not an indication for surgery. Just as many patients with obstructions are cured as without. Under proper treatment the spasm disappears, and the stomach can empty itself in six hours, even though a lot of scarring exists.

There were 22 hemorrhages reported in this group of cases. It is the impression of the author that they should be treated conservatively. The only cases that should be treated by surgery are those that may not improve because of underlying causes, such as arteriosclerosis or syphilis.

The injection treatment is condemned by the author, who believes that any benefit at all derived by the treatment is due to associated dietary measures.

JOSEPH T. DANZER, M.D.

Dyspepsia, Ulcer and Gastric Cancer. T. J. Anglem. New England J. Med. **235:** 322–325, Sept. 5, 1946.

The author points out that early in the present century Graham, Moynihan, and others commented upon the long history of gastric distress in many patients who ultimately died of cancer of the stomach. Gastric complaints must not be taken lightly. They should be investigated repeatedly if necessary. In many instances the early history of gastric cancer is typical of benign ulcer; sometimes it is only suggestive of ulcer.

The present study is based on 192 private cases: 33 were inoperable; 60 were found to be inoperable on exploration; 18 were suitable for palliative procedures; 20 were suitable for palliative resection; 4 refused operation; and 57 were resectable for cure. The average delay before the patient sought medical advice was nine months, and before the diagnosis was established there was a delay of seventeen months.

The early symptoms presented by the patients were epigastric pain or burning, distress, or fullness. In 17 per cent a history typical of ulcer was present, and in 27 per cent a history suggestive of ulcer was obtained.

It is believed that there is a 25 per cent error in the ability of roentgenologists to determine cancer of the stomach. There seems to be an irreducible error of about 10 per cent in the differential diagnosis of gastric ulcer and gastric cancer.

Recent reports show a mortality of less than 5 per cent in gastric resections, all by very competent surgeons. The present author believes resection for gastric lesions is the procedure of choice in view of the low mortality rate and the great possibility of many apparently benign lesions being actually malignant.

A plea is made for earlier diagnosis, closer supervision, and early operation in patients in middle life who complain of gastric distress. JOHN B. MCANENY, M.D.

Gastroscopy and Its Relationship to Roentgenology in the Diagnosis of Carcinoma of the Stomach. Herman J. Moersch and B. R. Kirklin. Gastroenterology **7:** 285–293, September 1946.

In the opinion of the authors, roentgen examination is preferable to gastroscopy as a routine procedure in the diagnosis of cancer of the stomach because of its ease of performance, rapidity, greater safety, and the fewer contraindications to its use. Gastroscopy is of extreme value as an adjunct to roentgen and clinical examination in the study and diagnosis of carcinoma, especially in those cases in which the roentgen findings are indefinite or at variance with clinical observations. The results of the two procedures in a selected series of 100 cases are presented, and three illustrative cases are recorded. The close collaboration of the gastroenterologist, roentgenologist, and gastroscopist is of great importance in bringing about the earlier diagnosis of gastric cancer.

Gastric Polyposis. J. H. Rappeport. New Orleans M. & S. J. **99:** 71–78, August 1946.

Gastric polyposis, while rare, should be considered in the differential diagnosis of ulcer, carcinoma, and benign tumors of the stomach. The author presents a brief historical review and discusses at some length the etiology, evaluating carefully the plausibility of the theories for both congenital and inflammatory origin. There is shown a definite relationship between gastritis, adenoma, and carcinoma of the stomach. The high incidence of achlorhydria in patients with gastric polyposis suggests a relationship, also, to pernicious anemia, and statistics bear this out, showing a greatly increased incidence of polyposis in the presence of that disease.

Pathologically, polyposis is of two general types. In *polyadenoma polypeaux*, there are many discrete polyps scattered over the gastric mucosa. They are usually pedunculated and many bear cysts. The other common type is the *polyadenoma en nappe*. In this type, the hypertrophy forms a well demarcated plaque, not cystic or pedunculated. It is composed of closely

placed folds of hypertrophic mucous membrane resembling the convolutions of the brain.

The polyps are described as either neoplastic or hyperplastic, though it is frequently difficult to distinguish the two types grossly. The congenital neoplastic polyps are usually pedunculated, but may be sessile. They are freely movable on the submucosa and are separated from each other by an area of normal mucosa. The mucous membrane away from the polyps may be normal or show atrophic gastritis. The connective tissue from the submucosa forms a central fibrous tissue core in these polyps. The hyperplastic polyps have defective margins which merge with the normal mucosa. Their edges rise to a hilly slope, and they are flatter and more expansive than the other type. They are firm and immovable on the submucosa, which is seen to take no part in the growth as a connective-tissue core. The neighboring mucosa shows definite signs of chronic inflammation.

Although gastric polyposis is essentially a benign condition, it is potentially malignant. The frequency of malignant change has been variously reported as from 5 to 40 per cent; 12 per cent is perhaps the most generally accepted figure.

There is no characteristic clinical picture for gastric polyposis. The condition may remain asymptomatic throughout life, or digestive symptoms of varying degree and duration may be present. Laboratory examinations show a high percentage of achlorhydria, absence of ordinary digestive secretions, and increased mucus. Blood findings may reveal a secondary anemia or occasionally a picture resembling that of pernicious anemia.

The differential diagnosis roentgenologically between polyps and gastric carcinoma is frequently difficult. The use of a viscid opaque medum given in small quantities may be of considerable help during fluoroscopy. The author recommends the use of films made with compression over the stomach. The polyps usually are more common on the greater curvature side of the lower third of the stomach, where they produce ragged indentations in the barium shadow, resembling mottled, fingerprint filling defects. Gastroscopic study should supplement roentgen study in all suspicious cases.

Radiation therapy for gastric polyps has not proved very successful. Gastric resection is definitely better than attempts at local excision of the polyps, and is the treatment of choice, since it eliminates the possibility of malignant change. BERNARD S. KALAYJIAN, M.D.

Induced Gastric Hyperkinesia. A New Technic for the Complementary Study of the Stomach and Duodenal Bulb. P. Porcher. J. de radiol. et d'électrol. **27:** 393–401, 1946.

The author's technic for study of the stomach and duodenal bulb consists in the administration of 1 cg. of morphine (about 1/6 gr.) ten minutes before administration of the barium meal. This induces a hypermotility of the stomach which has made it possible to uncover many ulcer niches that have eluded discovery on a routine examination.

The illustrations appended are not too convincing; many of those with the stomach exhibiting physiologic behavior appear to the abstractor to give more information than the films made after such vigorous peristalsis had been induced. I believe that many radiologists rely upon pylorospasm and a certain prognathous conformation of the pylorus that may go with it for a preliminary impression of peptic ulcer; a static pylorus may accompany some conditions. Drugs which alter such appearances sometimes rob us of essential information; they become unnecessary if the patient is recalled after a time for further observation.

Some of the duodenal bulbs which are described as questionable before the administration of morphine present such gross deformities of the "clover-leaf" or "butterfly" type that it is difficult to conceive of visualizing them in any manner which could be misinterpreted. PERCY J. DELANO, M.D.

Roentgenologic Studies on the Effect of Synthetic Folic Acid on the Gastro-Intestinal Tract of Patients with Tropical Sprue. R. L. Hernandez Beguerie and Tom D. Spies. Am. J. Roentgenol. **56:** 337–342, September 1946.

A normal subject and three patients with tropical sprue were used for this study. One of the patients with sprue served as a positive control and received no specific therapy; the others were treated with folic acid. After a barium meal consisting of 100 gm. of barium sulfate in 150 c.c. of water, films were taken at fifteen minutes, forty-five minutes, one hour, and each hour thereafter until the head of the barium column reached the cecum.

Synthetic folic acid in daily doses of 10 mg. was found to have a profound effect on the alimentary-tract function of patients with tropical sprue in relapse. The treated cases showed striking improvement which was evidenced by return of intestinal motility toward normal and the establishment of a continuous column of barium which was not interrupted by segmentation or fragmentation. The untreated patient showed no improvement within a similar period of time.

The roentgenographic findings most often observed in this series of patients with tropical sprue were mucosal edema of the small bowel, segmentation with alternating intestinal spasm, and dilatation and hypomotility of the small intestine. These abnormal small bowel patterns may also result from a nutritional disorder, hypoproteinemia, disease of the liver, disease of the mesentery, or any disease condition which produces submucosal edema. CLARENCE E. WEAVER, M.D.

Derangement of Midgut Rotation Producing Volvulus. Report of Two Cases. C. E. P. Markby. Brit. J. Surg. **34:** 80–83, July 1946.

Two cases of volvulus of the midgut are recorded, one implicating the pre-arterial segment, due to non-rotation, and one involving the postarterial segment, due to an inverse rotation.

The first patient was a girl 7 1/2 years old, with a history of constipation and vomiting from birth to the age of 5, at which time she presented symptoms of acute obstruction, relieved by lavage and enemata. She then remained well for one year, after which vomiting attacks recurred. On admission, the child's general condition was poor, with severe dehydration. Some 30 ounces of clear greenish bile-stained fluid were vomited daily. Roentgenoscopic examination in the erect position revealed three fluid levels before any opaque meal was swallowed. These were found to be in the dilated stomach and duodenal cap and in the region of the duodenojejunal flexure. After the barium meal, the second and third parts of the duodenum suggested

that the third fluid level was just distal to the duodenojejunal flexure. At operation the site of obstruction was found to be the beginning of the jejunum, which turned sharply to the right under the mesenteric vessels. It then spiralled around the mesenteric vessels in a clockwise direction for three complete turns. After the volvulus was corrected, the rare condition of the jejunum piercing the mesentery of a lower loop was found. The cecum was in the left hypochondrium and was anchored to the splenic flexure by peritoneal bands. The mesentery of the ascending colon was adherent to the transverse mesocolon. An anastomosis was made between the third part of the duodenum and the jejunum distal to the point where it pierced the mesentery. The cecum and ascending colon were separated from the transverse mesocolon and a cecopexy was performed. The child made an uneventful recovery and postoperative radiological examination showed a normal stomach and duodenum.

The second patient was a woman aged 49 years who had signs and symptoms of intestinal obstruction. Examination revealed abdominal distention and shifting dullness in the flanks. At operation the cecum was found to be distended and to have undergone a twist through 180 degrees around the ascending colon. After the volvulus was corrected, the ascending colon was found to enter a retroperitoneal tunnel and then extend upwards and to the left behind the root of the mesentery and the mesenteric vessels, to emerge at the normal splenic flexure. The patient died after thirty-six hours, from pulmonary embolism.

MAX CLIMAN, M.D.

Lymphoblastoma of the Terminal Ileum. Anthony C. Galluccio. New York State J. Med. **46:** 2049–2052, Sept. 15, 1946.

A case is reported of lymphoblastoma of the terminal ileum which produced a filling defect in the cecum as a result of intussusception. The patient had symptoms of abdominal pain, cramp-like and severe, in the right side of the abdomen on four occasions in eight months prior to entry. Physical and laboratory findings were not significant. The x-ray observations are carefully described and illustrated. The significant feature was the persistent intrusional filling defect in the cecum. The appendix was directed downward and medially. The terminal ileum did not fill. A subsequent examination showed a higher implantation of the cecum, with a curvilinear retention of barium at its base; the filling defect previously observed was less clearly defined.

The patient was operated upon, and a large, elevated lesion and two smaller lesions were noted in the terminal ileum, which had slipped through the ileocecal valve into the cecum. The intussusception was reduced and the terminal ileum and cecum were resected. The diagnosis was lymphosarcoma of the terminal ileum of the reticulum-cell type. The patient died after suffering numerous postoperative complications, and autopsy confirmed the diagnosis.

The author points out that some 400 cases of this type have been reported, but that the histogenesis is obscure and differentiation from a benign lesion is frequently impossible. Lymphosarcoma is essentially a non-surgical disease except when it originates in the gastro-intestinal tract, and here the site influences the prognosis considerably. In lymphosarcoma of the stomach gastric resection is believed to offer a better prognosis than in carcinoma. Lymphosarcoma in the jejunum and ileum forbodes a very poor prognosis, as does a primary lesion of a similar nature in the rectum. If the lesion is located in the cecum, the prognosis is much better, and about a 50 per cent survival can be expected.

In reviewing his case report, the author points out that one thing which might have suggested the preoperative diagnosis of lymphoblastoma rather than carcinoma was the fact that the patient suffered none of the manifestations which are normally expected with carcinoma of the cecum. The age of the patient (the third decade) and the absence of anemia were also against a diagnosis of carcinoma.

SYDNEY F. THOMAS, M.D.

Familial Diverticulosis of the Colon. Report of Seven Cases in One Family of Nine Persons. Harold L. Schlotthauer. Ann. Surg. **124:** 497–502, September 1946.

Both gross and microscopic examination of diverticula of the colon show them to be herniations of the mucosa and submucosa through defects in the muscle layer of the bowel. These are usually at the points of entrance of blood vessels. The author reviews the current literature and theories explaining why these herniations occur. He then presents evidence why he believes heredity should be considered as a major etiological factor.

A study is reported of a family consisting of seven brothers and two sisters ranging in age from forty-nine to seventy years. Although diverticula were demonstrated roentgenographically in all seven males, only two of them had ever had symptoms referable to the colon. The seven men showed a wide variation in size and weight, as well as in social status and habits of living, so that there was no apparent common feature of etiology other than ancestry. No evidence of diverticulosis could be demonstrated in either of the two sisters.

STANLEY H. MACHT, M.D.

Roentgenological Evidence of Appendiceal Abscesses. Arthur Dallos. Am. J. Digest. Dis. **13:** 279–284, September 1946.

The x-ray examination is often the decisive factor in establishing a diagnosis of appendiceal abscess. This is particularly true where the abscess follows weeks or months after subsidence of acute abdominal symptoms or in cases of a chronic type in which, as a result of a suppurative infection, the appendix has been perforated and become walled off, producing a localized abscess with tumor formation.

The author discusses several cases of appendiceal abscesses. The symptoms were varied but in each instance a deformed cecum was demonstrable on barium enema films taken both before and after evacuation. The points of diagnosis are as follows: (1) filling defects, either extrinsic or intrinsic or both; (2) fixation of cecum and last loop of ileum; (3) elevation and displacement of ileum; (4) hyperirritability and hypermotility with cecal spasm; (5) sensitiveness and tenderness of the area; (6) failure to visualize the appendix.

Conditions to be differentiated are carcinoma of the cecum, ileocecal tuberculosis, regional ileocolitis, actinomycosis, and invagination with intussusception. Extra-intestinal conditions, such as pelvic abscess and paranephritic abscess, are also worth considering.

JOSEPH T. DANZER, M.D.

THE MUSCULOSKELETAL SYSTEM

Juvenile Rheumatoid Arthritis. A Study of Fifty-Six Cases with a Note on Skeletal Changes. James A. Coss, Jr., and Ralph H. Boots. J. Pediat. **29:** 143–156, August 1946.

Fifty-six cases of rheumatoid arthritis in children have been observed at Columbia Presbyterian Medical Center (New York) since 1928. This group includes those cases in which the onset was at twelve years of age or earlier and represents 4.9 per cent of all cases of rheumatoid arthritis seen. The term Still's disease is not used as there seems to be no justification for this special grouping. In 18 instances (32 per cent) a family history of possibly related conditions was obtained. Thirty-two patients (57 per cent) had a history of respiratory tract infection including pneumonia, bronchitis, recurrent sore throat, sinusitis, or otitis preceding or associated with the onset of the arthritis. Thirty-nine patients (69 per cent) had a history of frequent ear, nose, and throat infections at some time in the course of the illness. Seven patients (12.5 per cent) had a preceding or concurrent history of gastro-intestinal disturbance. Only one patient had previously had rheumatic fever.

Thirteen patients had hepatomegaly, 17 splenomegaly, and 35 generalized lymph-node enlargement of varying degree. The reported lack of pain in Still's disease was not characteristic of this series. Practically every patient at some time complained of pain. In 31 cases no cardiac abnormality was discovered on physical examination or electrocardiography; 13 patients had tachycardia, 13 a systolic murmur of varying intensity (never harsh), and in 7 instances the electrocardiographic variation was great enough to be diagnosed as "evidence of myocardial damage" or "carditis." In 6 cases this reverted to normal on subsequent study. About 80 per cent of the patients showed a moderate anemia. In 37 per cent, on the basis of the highest figure recorded, the leukocyte count was above 15,000, and in 17 per cent it was above 25,000. The many similarities between rheumatic fever and rheumatoid arthritis lead to the interesting conjecture that recurrent hemolytic streptococcal infection and its consequences may play a part in rheumatoid arthritis, as has been suggested in the former condition.

Four roentgen criteria which seem to be most characteristic of juvenile rheumatoid arthritis (see Taylor *et al.*: Arch. Int. Med. **57:** 979, 1936) were selected: *viz.*, decalcification, bone destruction, joint space narrowing, and soft-tissue changes. X-ray studies were available in 47 patients and in each instance at least one of the above criteria was present. In 20 cases, two items were present; in 9, three, and in 7, all four changes were demonstrable. As would be expected, more marked changes were seen in the older patients, who had had the disease for a longer time. Joint changes as evidenced roentgenographically are often rather late to appear, just as in adult rheumatoid arthritis. Although some writers consider the roentgen picture of juvenile rheumatoid arthritis identical with that of rheumatoid arthritis in adults, additional features peculiar to arthritis in the young age group were noted in the present series. Many observers have remarked about the generalized failure of maturity and the bird-like facies in juvenile arthritis. Some films in this series showed a fusion of cervical vertebrae following arthritis. This change in children has usually been spoken of as congenital failure of segmentation, but the authors consider it a bony fusion resulting from arthritis in the involved area. Other patients showed brachydactylia. Twenty-two of the 56 patients were found to have disturbed skeletal patterns of varying degree.

Numerous forms of therapy were tried, with variable response. Twenty-two patients received gold (average course 600 mg. gold compound) as well as other measures of treatment. Because of the small number of cases, however, and the extreme variation in total dosage, it has been impossible to evaluate comparatively the response to this form of treatment.

Typical cases are reported, including the two fatalities. One of the fatal cases exhibited terminal amyloidosis.

Case of Albright's Syndrome (Osteitis Fibrosa Disseminata). R. C. Murray, H. J. R. Kirkpatrick, and Elemér Forrai. Brit. J. Surg. **34:** 48–57, July 1946.

The authors give a review of the literature on Albright's syndrome and report a case in which the diagnosis was based on the combination of progressive fibrous dysplasia of bone beginning early in life, the radiologic and histologic appearances of the osseous lesions, absence of changes in the blood chemistry characteristic of parathyroid adenoma, and pigmentation of the skin.

The patient was a man of 22, whose family history was negative for deformity. When he was four years old, it was discovered that he was knock-kneed, but medical advice was not sought until the age of nine. At that time the condition had become much worse. A wedge osteotomy was performed on the left tibia and fibula, and union was apparently normal. A fracture of the left femur as a result of slight trauma the following year also healed normally, but the deformities of the lower extremities grew steadily worse until, in another year, walking was impossible. At the time of examination by the authors there were fantastic deformities of both lower extremities, with gross bowing of the upper end of each femur, hyperextension deformities of both knees, and calcaneus deformities of both feet. The shaft of each tibia, in addition to showing a hairpin bend, was thickened. There was a large area of brown pigmentation covering the greater part of the left side of the body from the level of the iliac crest below to the nipple line above.

X-ray examination of the skeleton showed that both sides of the body were equally affected, the lower half being far more extensively involved than the upper half. The entire tibial shaft was involved, showing deformity, expansion, thinning of the cortex, decalcification, and a honeycomb of apparently cystic spaces of varying sizes. The femurs showed similar changes, but with areas of normal bone between. The other long bones contained one or more cystic areas and the shafts were decalcified but otherwise normal. There were no calculi in the kidneys. Plasma inorganic phosphorus was low, although in the cases recorded in the literature values have been within normal limits. Bence-Jones proteose was found on several occasions. Calcium metabolism experiments were essentially normal.

This patient was treated for correction of deformities by multiple osteotomies. It was found that union took place within normal time limits, even when the osteotomy was through a cystic area. These areas are not

replaced by bone and it is therefore advisable to excise contents of cysts and fill with bone. The pathological examination of the excised bone revealed that the consistency and structure of normal bone were lacking. The tissue was soft and cut easily. In some parts it consisted of soft fibrous tissue covered by a thin shell of cortical bone. In other parts there were areas of compact porous bone and areas of coarse and fine honeycomb structure. Histologic examination showed numerous irregularly formed and imperfectly calcified trabeculae of osteoid tissue in a matrix of cellular connective tissue. The cortical zone was narrow. Bone formation and resorption were in active progress.

The etiology of this disease is theoretical. The authors of the present paper believe that the lesions are secondary to some extraskeletal disorder of calcium-phosphorus metabolism, a part of a congenital anomaly, with an incidental localizing mechanism, partly congenital and partly acquired. In parathyroid adenoma, in addition to the generalized decalcification of the skeleton, there are multiple foci of osteitis fibrosa, which are presumably related to incidental factors of localization. Such incidental factors may be of a similar kind to those which determine the localization of the bone lesions in Albright's syndrome.

MAX CLIMAN, M.D.

Periarthritis of the Shoulder. J. D. McInnes. Canad. M. A. J. **55:** 131–133, August 1946.

Chronic adhesive subacromial bursitis, commonly called "frozen shoulder," causes pronounced limitation of shoulder function. The lack of understanding of the basic etiology has led to much ineffectual treatment.

Persistent shoulder pain radiating up the neck or down the arm, or loss of motion, may bring the patient to the physician. In addition to pain, there may be tenderness around the joint capsule, muscle atrophy, and limitation of active and passive motion. The appearance of the arm, wrist, and hand may be similar to that in hemiplegia or rheumatoid arthritis. X-ray examination usually reveals generalized decalcification of the bones of the shoulder girdle, and occasionally calcium deposits may be seen in the subacromial bursa.

Two typical cases are reported, in which the essential therapy consisted in forceful manipulation of the involved shoulder under anesthesia on two or more occasions, followed by a definite routine of passive and active motion, physiotherapy, and increasingly intensive exercise. Gradually, the range of movement increased and the pain on motion decreased. After a year, one patient had a normally functioning and painless shoulder, and the other patient was progressing favorably.

W. P. MARTIN, M.D.

GYNECOLOGY AND OBSTETRICS

Maternal Obstetric Paralysis. John Totterdale Cole. Am. J. Obst. & Gynec. **52:** 372–386, September 1946.

Maternal obstetric paralysis, or traumatic puerperal neuritis, is a condition observed during the puerperium, and occasionally during labor. It is characterized by pain and paresthesias and a variable paralysis of one or both of the lower extremities. The condition is rare, but early diagnosis and treatment are important.

Objective and subjective findings are inconstant, with pain during labor, referred along the course of the sciatic nerve, being the earliest sign, but frequently obscured by sedatives and analgesics. As uterine contractions become more intense, the pain increases. It may be associated only with uterine contraction.

Various paresthesias occur, and the patient may complain of "numbness," "pins and needles," or thermal changes. Spasmodic contractions or paralysis of muscles may be observed. The degree of nerve involvement varies, but "foot drop" is a rather constant finding, and other muscles of the leg and thigh are involved. The ankle and knee jerks may exhibit abnormalities, while sensory findings will range from almost normal to complete loss. In severe cases, atrophy and wasting of muscle groups will eventually follow. To be differentiated are localized bone or muscle changes, stirrup injuries, embolism, tumors, avitaminosis, poisoning, hysteria, and herniated disk.

After reviewing the various theories as to the etiology, the author concludes with Barns (J. Obst. & Gynec. Brit. Emp. **50:** 13, 1943) that the paralysis is chiefly due to trauma of the lumbosacral cord by the fetal head, or by instruments, a view first propounded by Hünermann. In many cases cephalopelvic disproportion exists. In a pelvis in which the x-ray findings show that the posterior ilium is short, the ala of the sacrum has only a shallow anterior concavity, and the promontory does not encroach on the capacity of the posterior segment, it seems reasonable that that portion of the vertex in relation to the ala can exert real pressure on the lumbosacral cord when the fetal head seeks an obliquity. This is why, barring instrumental injury, the lesion is almost exclusively unilateral. Pain and other symptoms appear rather late in labor because the head exerts its greatest pressure on the nerve cord at the time of engagement and at the height of a uterine contraction.

In those cases attributed to instrumental manipulation, the degree of damage depends not only on the short period of compression by the posterior blade, but also on the amount and force of the traction used.

The author reports in detail seven cases, including pelvimetric studies before delivery and an x-ray review postpartum, after obstetric paralysis had been diagnosed. The x-ray findings, though characteristic, are not diagnostic, for pelves with these features are seen in which no nerve trauma occurs.

Early signs of lumbosacral cord compression should be watched for in trial labors, and their appearance necessitates extreme care in further management. Treatment consists of support of the injured extremity, active and passive motion, galvanic stimulation, vitamin therapy, and the use of a walking brace. Prognosis as to the degree and speed of recovery should be guarded.

WILLIAM P. MARTIN, M.D.

Variations in the Female Pelvis. C. Nicholson and H. Sandeman Allen. Lancet **2:** 192, Aug. 10, 1946.

The authors criticize the Caldwell-Moloy classification because of its lack of precision. They say: "Classification may be a fine weapon in the armament of science, but classification without precise definition is simply the negation of science and can only lead to the multiplication of types until every example has a type of its own." They point out that Caldwell and Moloy already have thirty types. They seek to disprove the facts that (1) the android pelvis is a male pelvis, associated with other male stigmata in the female; (2) that the android pelvis and to some extent the anthropoid

pelvis are associated with narrow outlets; (3) that the android pelvis is associated with difficult labor. They produce evidence that they feel disproves these propositions, which they say Caldwell and Moloy have propounded. They attempt to produce statistical proof that the android pelvis is associated neither with contraction of the pubic angle, nor with difficulty in labor, and point out that any deformities of the pelvis which lead to difficult labor are due to deficient nutrition in childhood.

Whereas Caldwell and Moloy have wished to emphasize the shape rather than the size of the pelvis, the present writers apparently wish to reverse this and go back to the old idea that size alone counts. [An editorial discussion of this subject, with a critical evaluation of the opposing views, appeared in Radiology for May (48: 527, 1946).] PAUL C. SWENSON, M.D.

Pelvimetry. E. P. Allen. New Zealand M. J. **45:** 370–375, August 1946.

The author seeks to answer the question: "Upon what criteria can we predict a normal labor?" His technic calls for five films: (1) an anteroposterior film with the patient supine, with a firm pad under the concavity of the lumbar spine; (2) a localized double-exposure film of the pelvis, with full stereoscopic shift of the tube between exposures; (3) a lateral soft-tissue film of the uterus; (4) a lateral view of the bony pelvis, with markers anteriorly and posteriorly in the mid-line; (5) a film of the subpubic angle, after the method of Chassard and Lapiné. The stereoscopic reconstruction method of Caldwell and Moloy is not looked upon with favor. Such a method, the author believes, can be accurate only after years of experience.

The pelvis is measured at three levels: the inlet, the midplane, and the outlet. At the inlet the two main diameters to be measured are the transverse and the obstetrical conjugate. Of the latter the author says: "There is no doubt that in some cases the classical conjugate does not represent the available anteroposterior diameter." As an example he cites the extreme case of a sacrum in which the first segment is largely lumbarized and the pubosacral angle is much less than 90 degrees. In such a pelvis it is clear that the "least" conjugate (from the upper border of the symphysis pubis to the nearest point on the sacrum) rather than the classical conjugate represents the available sagittal plane diameter. When the pubosacral angle is greater than 90 degrees, however, the classical conjugate is also the least conjugate. In view of these considerations, the author measures the classical conjugate unless the angle is under 90 degrees, in which case the least conjugate is measured. Considering the two major diameters as the two axes of an ellipse, the brim area can be derived from the formula $\pi \frac{ab}{4}$, where a and b are the two diameters. On the basis of his experience, the author considers a conjugate of 100 mm., in New Zealand at least, an absolute indication for cesarean section in the case of the average fetal head.

At the midplane, or the least pelvic plane, the usual diameters measured are the anteroposterior and the bispinous. As with the inlet, the two diameters can be regarded as the major and minor axes of an ellipse, and the midplane area can be calculated accordingly. Nicholson is quoted as fixing the critical area of the midplane at 90 sq. cm., and the author's experience is in good agreement with this figure. In 35 per cent of his cases, the bispinous diameter was below 100 mm. He feels, however, that this diameter lies too far posterior to seriously affect delivery, since one must assume the head to be fully flexed and molded by the time it reaches this area. He suggests, as more useful, a transverse measurement anterior to the bispinous diameter, as the distance between the flat opposing surfaces of the bodies of the ischia in front of the spines. He sets down as a criterion for midplane contraction a critical area of 103 sq. cm. calculated from the anteroposterior and true transverse diameters. The bispinous diameter is of significance only if it is less than 100 mm. and lies well forward as shown by a relatively long posterior sagitta diameter.

Consideration of the outlet has generally been confined to measurement of the subpubic angle and a so-called bituberous diameter. Measurement of the subpubic angle is, however, inaccurate, and the bituberous diameter has no clearly defined end point. Furthermore, neither measurement has any particular significance unless it is related to the position of the tip of the sacrum. The author offers what he believes is a new approach to this problem. He superimposes upon the film of the subpubic angle a transparency consisting of a half circle 10.4 cm. in diameter, which is taken to represent the anterior half of the fetal head with a slight allowance for enlargement on the film. This transparency is so placed that the circle touches each side of the subpubic arch and the scale with which it is provided passes through the symphysis. The "symphysis-biparietal" distance as read off on the scale represents the least distance behind the lower edge of the symphysis at which the greatest transverse diameter of the head can negotiate the subpubic arch and is the measure of the space under the subpubic arch required for the anterior half of the head. To determine whether the sacrum will interfere with delivery of the posterior half, the symphysis-biparietal distance is increased proportionately to allow it to be fitted to the lateral film. This magnified distance is taken off on a compass, and with the center on the lower edge of the symphysis an arc is described across the tuberosities. This represents the locus of the greatest transverse diameter of the head. Where the arc intersects the ischiopubic rami or the posterior surface of the tuberosities a mark is made. The distance of this mark from the sacral tip is measured and corrected for divergent distortion and is the "available posterior sagittal outlet." To permit delivery of a normal head this diameter must be more than 50 mm.

In summary, the following critical limits are listed:

Inlet area: 110 sq. cm.
Obstetrical conjugate: 110 mm.
Midplane area: 103 sq. cm.
Posterior sagittal outlet: 50 mm.

SYDNEY F. THOMAS, M.D.

Six Cases of Venous Intravasation Following Intrauterine Lipiodol Injection. Alice Bloomfield. J. Obst. & Gynec. Brit. Emp. **53:** 345–346, August 1946.

Conditions predisposing to venous intravasation following intrauterine injection of lipiodol for salpingography are said to be: (1) injection of lipiodol within a period of less than eight days after the termination of menstruation, (2) injection immediately after dilatation of the cervix, (3) injection too soon after curet-

tage, (4) injection just prior to the onset of menstruation, and (5) injection with excessive force.

Six cases in which pelvic venous intravasation occurred are analyzed, with these contraindications in mind. In one patient salpingography was carried out just after the end of the menstrual period. Films showed one tube to be freely patent and the other possibly blocked at the cornua, with intravasation of dye into the pelvic veins. The patient felt no ill effects at the time, although a roentgenogram of the chest showed fine flecks of scattered lipiodol. After returning home, however, she experienced prolonged irregular vaginal loss, followed by a heavy "period," suggesting a mild pelvic inflammatory reaction. Salpingography was carried out in the second patient four to five days before the onset of menstruation and excessive pressure may have been used. The degree of intravasation of the pelvic veins was marked. A chest film was not taken for two or three weeks, and at that time the lung fields were clear. In 3 cases the intravasation was attributed to a new and rather rough-surfaced rubber covering to the oil-bearing cannula, this having presumably traumatized the cervix and permitted the ingress of lipiodol to the pelvic veins. All 3 of these patients had hemoptysis and a roentgenogram of the chest in each instance showed "a very fine, faint stippling giving a granular appearance through both lungs." The possibility that this was due to lipiodol in minute quantities in the terminal capillaries is suggested. No cause for the intravasation was evident in the sixth case.

GENITO-URINARY SYSTEM

Intravenous Urography in Acute Renal Colic. Thomas J. Florence, William S. Howland, and H. Stephen Weens. J. Urol. **56:** 284–291, September 1946.

The point is made that despite voluminous literature concerning renal colic, little attention is given to the early diagnosis of its underlying causes. The authors feel that in addition to the usual procedures, such as urinalysis and survey roentgenograms, intravenous urography should be employed more frequently as an early diagnostic measure. Hematuria is not always conclusive evidence of colic, and the survey roentgenogram frequently has to be supplemented by further studies for diagnosis or verification. Cystoscopy and retrograde pyelography are not considered practical for immediate routine procedure.

Intravenous urography was performed in 23 patients during episodes of acute renal colic. In a number of these cystoscopy and retrograde pyelography were also done for better evaluation of the intravenous urography. In 12 of the patients calculi were found to be the cause of the colic. In the remainder ureteral stricture, kinking of the ureters, and congenital anomalies of the urinary tract were considered as etiologic factors. In only one case were there no abnormal urographic findings.

Opacification of the kidney (nephrogram) during intravenous urography is stressed as a sign of ureteral blockage. This was observed in 10 cases, 5 of which were due to calculous, and the remainder, to non-calculous obstruction. The authors explain the phenomenon of opacification as follows: In complete ureteral obstruction the intrarenal pressure gradually rises to a level at which glomerular filtration is suppressed. The tubular epithelium, however, in spite of ureteral obstruction retains its function and may excrete diodrast, which accumulates in the tubular apparatus leading to a diffuse opacification of the renal shadow on intravenous urography. As soon as the obstruction is relieved, the contrast medium passes readily from the tubules into the kidney pelvis and the renal shadow returns to normal. The phenomenon may be artificially produced. Further work in connection with nephrography is to be published.

DAVID S. MALEN, M.D.

Ditopax, A New Excretory Urographic Medium: A Clinical Report on 1280 Injections. W. M. Kearns, Hans Hefke, and S. A. Morton. J. Urol. **56:** 392–398, September 1946.

Ditopax (Bis-diethanolamine N-methyl-3,5-diiodochelidamate) was used for 1,280 injections in 1,232 patients. Blood chemistry and blood pressure determinations, electrocardiograms, and urinary iodine excretion estimations were obtained in a group of 10 patients. In addition, a comparison was made of radiographic densities with Ditopax, Neo-iopax and Diodrast in groups of 10 and 7 patients. Composite observations for Ditopax reactions on 915 patients are tabulated.

The conclusions reached are as follows: (1) Ditopax is safe. (2) Of 915 patients 75 per cent showed no reaction; 25 per cent showed inconsequential reactions. (3) The diagnostic value is rated in the following order: Neo-iopax, Ditopax, Diodrast. (4) On the basis of this series, Ditopax may be said to cause less arm pain than Neo-iopax and less systemic reaction than Diodrast.

PAUL R. NOBLE, M.D.

Diverticula of the Prostate. Ernest Hock. J. Urol. **56:** 353–367, September 1946.

Nine cases are presented illustrating the diagnosis by urethrography and urethroscopy of chronic diverticular prostatitis and its treatment by transurethral electroincision.

During the past decade the importance and frequency of chronic prostatitis have become more and more recognized. Little attention has been given, however, to a certain form of prostatitis characterized by the formation of diverticula. These prostatic diverticula are not very rare and have been repeatedly described and discussed by such writers as Luys, Chevassu, Thompson, Michel, and others. The best account is given by Heitz-Boyer of Paris who studied in detail the pathology, development, clinical importance, and treatment of prostatic diverticula. [References to his numerous papers are included.]

Prostatic diverticula may develop from any "simple" prostatitis. The portals of infection are (1) from the posterior urethra through the prostatic ducts; (2) from the epididymis through the ejaculatory ducts; (3) through the blood stream, metastatic; (4) through the lymphatics from adjoining organs. Lymphogenous infection plays a comparatively unimportant role; infections from the testicle and epididymis through the vas deferens occur, but are not frequent. In most cases the bacteria enter the gland either from the urethra or through the blood stream. Often there is an infectious focus, removal of which is followed by healing of the prostatitis.

Irrespective of the mode of bacterial invasion of the prostate, the first pathological changes take place in the

epithelial lining of the ducts and acini. There are swelling and narrowing of the ducts, epithelium is shed, and the outlet for the contents of the acini is blocked. As a consequence, there is stagnation of the intra-acinar exudate and dilatation of the acini. Then follows reactive new formation of connective tissue around the affected acini. At this stage the gland usually responds readily to simple treatment, as massage, heat, etc., unless it is constantly reinfected from some focus. If the inflammation is more severe and lasts long enough, the dilatation of the acini progresses, the intra-acinar septa are broken down, resulting in the formation of larger cavities. In the periphery of the affected area new connective tissue is formed, and finally irregular, ramified, large cavities surrounded by dense fibrous tissue may develop. These cavities are connected with the posterior urethra through dilated prostatic ducts which, however, are not wide enough to allow a good drainage of the cavities. Furthermore, any urethral obstruction distal to the prostate will tend to dilate the cavities by back pressure. This is in agreement with the fact that prostatic diverticula are found most frequently in cases of stricture of the urethra of long standing. By the contact of urine with debris in the cavities, salts may be precipitated, and prostatic stones develop. These may block the ducts and so, again, contribute to the growth of the cavities.

These cavities, or prostatic diverticula, take a considerable time to develop, often five or ten years or longer. Usually they produce only slight symptoms or none at all. They constitute, however, a locus minoris resistentiae ready to flare up if more virulent organisms enter. Then the infection may spread rapidly and affect the whole urinary system. In rare cases even septicemia may develop.

The diagnosis of prostatic diverticula can be made only by x-ray or urethroscopic examination. The x-ray film does not always show the cavities. The contrast medium sometimes fails to penetrate through the prostatic ducts into the diverticula or the shadow of the urethra may overlap a small diverticulum. Films in at least two projections are therefore desirable. If no diverticula are found by the usual technic of urethrography, they may still be visualized by the following procedure: After introduction of the contrast medium into the bladder, the patient is asked to void and at the same time his urethra is compressed and the x-ray film is taken. The urethroscope shows the dilated ducts leading to the diverticula very well, but does not give information about their size and direction. Therefore, both methods should be applied.

Treatment by opening and drainage of the pus cavities is outlined by the author. His procedure of choice is transurethral, endoscopic incision of the cavities with high-frequency current. He indicates that some cases are suitable for the resectoscope, especially those complicated by sclerosis of the bladder neck. Open operation, transvesical or perineal, is not advised as a routine procedure, as in most cases satisfactory results can be obtained by simpler methods.

MARLYN W. MILLER, M.D.

Roentgen Examination of the Male Urethra. Howard Gaudin. New Zealand M. J. **45:** 376–383, August 1946.

The author points out that the roentgen examination of the male urethra is not widely practised despite the fact that it can sometimes demonstrate disease which cannot be diagnosed in any other manner. His method is a modification of that described by Kohnstam and Cave (Radiological Examination of the Male Urethra, New York, Wm. Wood & Co., 1925). He uses as a contrast medium a 40 per cent suspension of barium sulfate in water with gum tragacanth in the proportion of 0.5 to 1.0 per cent, and obtains two views, one before and one after injection, both in the right oblique position. The method of injection is that used by Kohnstam and Cave. A conical glass flask constitutes an air pressure reservoir and air pressure is created by means of a sphygmomanometer bulb. This reservoir is connected to a mercury manometer and to the barrel of a glass dressing syringe large enough to contain medium for several examinations. The pressure at which the sphincter vesicae relaxes may be noted and one may watch the flow of the medium and time the exposure so that it is made while the barium mixture is flowing in the urethra.

Three main entities are discussed: the normal picture, the strictured urethra, and the enlarged prostate. The normal measurement of the prostatic urethra is the distance between the verumontanum and the neck of the bladder, which is approximately 2.0 cm., but enlargement of the prostate increases this distance.

The illustrations accompanying the paper are excellent and, as is so frequently the case, present the subject more effectively than any written description.

SYDNEY F. THOMAS, M.D.

SINUS TRACTS

Injection of Iodized Oil as an Aid to Closure of Draining Sinuses. George Crile, Jr. U. S. Nav. M. Bull. **46:** 1174–1177, August 1946.

An unrecognized sinus is one of the most common causes of failure of a wound to heal. It is suggested by gray, edematous granulations, bathed in pus. If a sinus persists for several weeks, one must always suspect that it contains foreign material, enters a hollow viscus (fecal fistula), or is kept open by a poorly drained abscess cavity or a piece of infected bone. When the drainage is profuse, a non-metallic foreign body or a piece of necrotic bone is probably present.

After the presence of a sinus is established, a roentgenogram should be taken to rule out osteomyelitis, sequestra, or metallic foreign bodies. If these are not present, iodized oil should be injected under fluoroscopic control and the tract filled. Roentgenograms are then taken either stereoscopically or from both anterior-posterior and lateral angles to determine the extent of the tract. No attempt is made to retain the oil in the wound. If the x-rays show no obvious cause for the sinus, there is better than even chance that the sinus will close within one or two days following the injection of the oil and remain closed. If the drainage persists, it is often worth while to give penicillin, both locally and systemically, and, after two days, to reinject the sinus with iodized oil. The penicillin is given for two days more, and in many instances closure of the sinus will ensue.

The iodized oil often remains in the tissues for several months and can be demonstrated by x-ray, despite the fact that the sinus is closed.

Within a year the author had observed closure of approximately 20 large sinuses following the injection of iodized oil. Eight brief case reports are presented.

FOREIGN BODIES

A Simple and Accurate Method for the Localisation of Intra-Ocular Foreign Bodies. G. I. Scott and P. A. Flood. Brit. J. Radiol. **19:** 318–322, August 1946.

If an opaque intra-ocular foreign body is suspected, a preliminary film is made in the postero-anterior position with the head slightly extended so that the petrous pyramid shadow will fall below the orbit. If a foreign body is visualized, a second postero-anterior projection is made. This is a double exposure, the first made with the eyes fixed straight ahead and the second with the eyes looking about 20 degrees downward. If the shadow of the foreign body shifts, it is either in the globe or in contact with the sclera. Accurate localization is then in order. A ring of thin silver wire perforated at 12 and 6 o'clock is sutured to the limbus. It is not necessary to locate these perforations at exactly 12 and 6 o'clock but a mark should be made on the sclera opposite each with a small needle dipped in Chinese ink. Two exposures then are made, a postero-anterior and a direct lateral with the eyes fixed straight ahead. From these two films the localization of the foreign body may be charted on a diagram with greater accuracy than the surgeon needs. The marks on the sclera are sufficient guides for him.

The technic of surgical removal of the foreign body is also described. SYDNEY J. HAWLEY, M.D.

RADIOTHERAPY

NEOPLASMS

Radiation Treatment of Cerebral Tumors. R. McWhirter, J. Pennybacker, Dorothy S. Russell, J. Jackson Richmond, *et al.* Proc. Roy. Soc. Med. **39:** 673–680, August 1946.

McWhirter reported a series of 115 histologically proved brain tumors treated with x-rays between 1936 and 1944. In the majority of cases a decompression operation was carried out prior to the application of radiation. The treatments were usually given with radiation generated at 250 kv. and filtered with a Thoraeus filter, through two fields. A minimum tumor dose of 4,500 r in four weeks was planned but in some cases was not reached. In attempting to assess accurately the effect of radiotherapy, clinical observation, x-ray studies, further surgical exploration, and postmorten studies were used.

Brain tumors were classified into four main groups. The first group, numbering 23, consisted of the radio-insensitive tumors, *i.e.* astrocytomas, ependymomas, oligodendrogliomas, and radio-insensitive meningiomas, and showed a 26 per cent five-year survival. The survival rate did not differ materially from that for cases receiving no radiotherapy. There was no clinical proof that the tumor in these cases had diminished in size, and tissue removed at a later date, either operatively or at autopsy, showed no significant effect of the irradiation. The five-year survival rate is due to the naturally slow growth of these tumors. The rate of growth may have been slowed down to some extent by the irradiation.

The second group, numbering 38, consisted of radiosensitive non-metastasizing tumors and was made up of radiosensitive meningiomas, hemangioblastomas, and neuro-epitheliomas. It showed a five-year survival rate of 61 per cent. The meningiomas formed the larger part of this group. The gross differentiation between radiosensitive and radio-insensitive meningiomas is not always easy nor can they be distinguished by histologic study in all cases. The author gives several descriptive points which may be of value in making a differentiation.

The third group—the radiosensitive metastasizing tumors—included the medulloblastomas, ependymoblastomas, malignant choroidal papillomas, and pinealoblastomas. This group numbered 29, and the five-year survival rate was 14 per cent. The tumors are highly radiosensitive but difficult to control because of their extreme tendency to metastasize to other parts of the central nervous system. More recently, localized treatment has been replaced by treatment over extensive fields including all of the cerebrospinal axis.

The fourth group was made up of those questionably radiosensitive tumors, the glioblastomas. None of the 25 patients survived five years.

The author says little about pituitary tumors except that the eosinophil tumors are suitable for x-ray therapy, which may bring about some improvement in the accompanying acromegaly. He also believes that basophilic pituitary tumors and craniopharyngeal carcinoma may be benefited to a considerable extent by irradiation.

The over-all five-year survival rate in the series reported was 27 per cent.

Continuing the discussion, Pennybacker emphasized the difficulties of assessing the value of irradiation in brain tumors. "Have we really any evidence," he asks, "that radiation treatment has an effect on brain tumours?" To this query he replies: "I think anyone who has seen the response of a medulloblastoma to a course of x-ray therapy would say yes. But even with these tumours it is a prolongation of life and not a cure which we achieve." As to whether a cure is ever brought about by radiation, he reports one case in which this seems to have been achieved—a malignant glioblastoma of the right frontal lobe. The patient died seven and a half years after the onset of symptoms, having received radium therapy and three courses of deep x-ray therapy. No evidence of tumor was found at autopsy but there was an extensive subcortical necrosis, maximal in the field of irradiation, so it must be assumed that the radiation which killed the tumor was also responsible for the patient's death.

The histologic findings in this and a similar case are described by Russell, who also reported some animal experiments to determine the nature of the changes induced by radiation.

The other discussants added brief remarks on the problems involved. B. S. KALAYJIAN, M.D.

Radiation Therapy of the Cancer of the Esophagus. J. Borak. Am. J. Digest. Dis. **13:** 249–252, August 1946.

That cancer of the esophagus is generally considered to be radioresistant is not easily explained, as over 95 per cent of these tumors are of the squamous-cell type, and squamous-cell cancers in other parts of the

body are amenable to x-ray therapy. Lacassagne, in experiments on animals, found that the epithelium of the esophagus behaved no differently than that of any part of the body. Regaud and Coutard found that the squamous-cell covering of the skin and mucous membranes would degenerate when sufficient radiation was applied, but the underlying tissue would only exhibit signs of inflammation and the epithelium would eventually be regenerated from the neighboring areas.

The fact that the esophagus has thin walls is a serious handicap in the use of radium because of the intense effect on adjacent tissues. The difficulty of external irradiation lies in the distance of the esophagus from the surface. It is roughly 8 to 12 cm. from the chest wall in its middle and lower portions. If 4,000 r is to be given to an esophagus, 10,000 to 12,000 r must be given to the skin. This amount is difficult to apply without causing serious injury to the neighboring tissues. A technic is described by the author in which 4,000 r is given to the tumor within four weeks. For this purpose the patient is irradiated twice daily, six to eight hours apart. At each session two fields, each 5 × 12 cm., are treated. The wall nearer to the tumor has three fields parallel to one another; the opposite one has one to three fields depending upon the depth of the tumor. At 200 kv., the single dose is 150 r to the skin.

Two patients treated in the manner described are alive and apparently free from the disease, one for a period of seventeen months, the other for twenty-one months. JOSEPH T. DANZER, M.D.

Unusual Metastatic Manifestations of Breast Carcinoma. I. Metastasis to the Mandible with Report of Five Cases. Frank E. Adair and Julian B. Herrmann. Surg., Gynec. & Obst. **83:** 289–295, September 1946.

Carcinomatous metastasis to the mandible is rare, even from lesions which frequently produce osseous metastases, as carcinomas of the thyroid, prostate, and breast. Only 16 cases of carcinoma of the mandible secondary to mammary cancer, including 5 presented in this paper, have been recorded.

The first indication of a metastatic tumor of the mandible may be pain, frequently associated with a loose tooth; later a lump on the jaw may become apparent. In 2 of the authors' cases paresthesia of the side of the face and of the buccal and gingival mucosa developed some time before any other evidence of mandibular disease became apparent. Although most mandibular metastases are associated with metastatic deposits in other bones, there have been instances of a single metastasis localized to the mandible occurring a number of years after mastectomy for cancer. Such a lesion may be mistaken for a primary growth and lead to an unwarranted radical procedure.

In the cases reported roentgen irradiation usually gave some relief from pain, and in one case regeneration of bone in the tumor area was noted.

In an effort to explain the rarity of secondary carcinoma of the mandible, the authors briefly review the classical theories of metastasis. The theory of Piney (Brit. J. Surg. **10:** 235, 1922) seems to be appropriate to this particular problem. He believed that bone metastases are produced by blood-borne emboli which lodge in the thin-walled blood channels of the red marrow, and he was able to demonstrate plugs of epithelial cells in this location. He was unable to demonstrate lymphatics in bone marrow and concluded they are absent. He postulated that not only must the cancer emboli reach the marrow but the current here must be slow enough to allow the cells to grow. These conditions are satisfied by the red marrow which, because of its great vascularity, produces a widening of the blood stream bed with a consequent slowing of the current.

The localization of bone metastases is thus explained on the basis of red bone marrow distribution. In the infant all the bones contain red bone marrow, but in the adult this has been replaced by fat except in the skull, sternum, ribs, clavicles, scapulae, vertebrae, os innominatum, and the proximal portion of the extremities, where red marrow continues to persist throughout life. Recent investigation by Box on a series of human jaws revealed only yellow marrow in 75 per cent. In those instances in which he found small patches of red marrow he believed its presence was due to vestiges of the original red marrow or to local stimuli secondary to trauma or infection.

Piney ascribed the infrequency of metastases below the elbow and knee to the absence of red marrow in these locations. He believed that bone metastases may occur occasionally by way of the lymphatics but that the principal route is hematogenous. It is probable that both lymphogenous and hematogenous routes are essential to bone metastasis.

Case histories are included and a list of references is appended. ALFRED O. MILLER, M.D.

Palliative Roentgen Therapy of Bone Metastases from Breast Carcinoma. L. R. Sante. J. Missouri M. A. **43:** 533–535, August 1946.

The author presents 5 cases in which bone metastases from breast carcinoma were treated with roentgen rays (200 kv.p., 1 mm. Cu and 1 mm. Al filter). All the patients were women of premenopausal age and all except one had had operative removal of the breast and microscopic studies showing carcinomatous lesions of various types. The metastatic lesions were mainly in the spine, pelvis, femurs, and skull. In all cases there was a remarkable improvement with relief of pain and, in most instances, healing of the areas destroyed by the metastases. Several of the patients required repeated series of treatments for new metastases. The author urges careful observation of these patients and prompt application of radiation to the areas showing evidence of metastasis. He believes that, in many instances, several years of life with freedom from pain can be added for these patients.

[It has been the reviewer's experience that pain may precede by a considerable period definite roentgen demonstration of bone destruction and that it is sometimes wise to give radiation therapy even before definite roentgen evidence of metastasis is present. Roentgen therapy will give considerable relief in arthritis of the spine and the dosages used, while smaller than those for metastases, will serve as a therapeutic test in these suspicious cases.]

BERNARD S. KALAVJIAN, M.D.

Neoplasms of the Testis. Oscar Auerbach, Osborne A. Brines, and Asher Yaguda. J. Urol. **56:** 368–374, September 1946.

The authors report 26 cases of testicular tumor coming to autopsy in a Naval Hospital, comprising 20 per

cent of all the tumor cases autopsied at this institution. What percentage this number represents of testicular tumors seen at this hospital is not stated.

The cases in this series showed no predilection for either side. In most instances the tumor was painless. The size ranged from 0.5 to 10 cm. in diameter and did not determine the extent of metastatic involvement. Testicular swellings were noticed for an average of three months before a diagnosis was made. The interval between the establishment of diagnosis and death averaged eleven months and varied inversely with the duration of the disease before diagnosis.

Metastasis followed a uniform pattern in nearly all cases. Direct extension and spread along the spermatic cord were not seen. Metastasis to the retroperitoneal lymph nodes, lungs, mediastinal lymph nodes, and liver was observed in that order.

The authors give their own histologic classification of tumors of the testicle. They believe that nearly all malignant tumors of the testis are embryonal or teratoid in origin. They recognize two main groups, homologous and heterologous, "which merely means that the latter, plus chorionepithelioma, should be labeled teratomas, of varying degrees of malignancy, and the remainder may be called embryonal carcinomas or seminomas." Embryonal adenocarcinoma was the most prevalent type in this series.

Treatment consisted of immediate orchiectomy and postoperative deep x-ray therapy to the chest, abdomen, and enlarged lymph nodes in the axilla and supraclavicular regions. VERN W. RITTER, M.D.

NON-NEOPLASTIC DISEASE

Irradiation of Nasopharyngeal Lymphoid Tissue: An Evaluation. Lawrence R. Boies. Arch. Otolaryng. **44:** 129–140, August 1946.

The results of radium or radon irradiation of excessive lymphoid tissue in the nasopharynx in 73 children are discussed. *Group I.* Fifty-four patients had obvious hearing impairment and when tested showed a generalized depression of the hearing threshold through the speech frequencies and the high notes. All had had tonsils and adenoids removed and had a variable amount of nasopharyngeal lymphoid tissue, with abnormal changes in the tympanic membrane. All failed to respond to the usual measures for relieving this condition. Normal hearing was recovered after irradiation in 46 of this group. *Group II.* The loss of high notes was not restored by irradiation of the tubal orifices in 4 patients with hearing loss for frequencies higher than 2,048 and with a small amount of lymphoid tissue in the nasopharynx adjacent to the orifices. All of these patients gave a history of aural symptoms and recurrent infections of the upper respiratory tract. *Group III.* A group of 7 patients was treated for a hearing loss approximating the 30 decibel level or lower through the speech frequencies with a more marked loss for higher notes. It was suspected that a cochlear lesion was present in each case. Irradiation of nasopharyngeal lymphoid tissue did not produce an improvement in hearing in any of these patients. *Group IV.* Five patients with a slight loss of hearing for the speech frequencies and for high notes and a complaint of nasal obstruction were benefited by irradiation. *Group V.* Treatment was of questionable value in 3 patients with a mucoid discharge through a chronic perforation of the drum membrane.

Keloid Formation in Both Ear Lobes. D. F. Weaver. Arch. Otolaryng. **44:** 212–213, August 1946.

Rather large recurring keloids, involving both ears, developed in a Negro woman following the piercing of the lobes for the insertion of ear rings. The growths had been excised, twice from one ear and once from the other. At the time of examination, firm tumors, one measuring 4 × 3 × 1.5 cm. and the other 3 × 2.5 × 2 cm., were present. These were completely excised and roentgen therapy was given over each field (field size, 2 × 4 cm.; 150 kv., 0.25 mm. Cu and 1 mm. Al filtration, focal skin distance, 50 cm.) for a total dose of 195 r (in air). Thirty-two months later there was no evidence of recurrence of the keloids.

Twelve Years Experience in Roentgenotherapy for Chronic Arthritis. John G. Kuhns and Sidney L. Morrison. New England J. Med. **235:** 399–405, Sept. 19, 1946.

After several years experience in the treatment of arthritis with irradiation, the authors decided that a more critical analysis of the patients and their response to therapy was indicated. They therefore selected 252 patients with rheumatoid arthritis and 118 patients with osteoarthritis for treatment and study.

Each joint received 200 r in air twice weekly over two to four areas, for six treatments, totaling 1,200 r per field. In rheumatoid arthritis of the spine 100 r was administered to each of two areas, an upper and lower, every other day for twelve treatments.

Subjective evidence of change could not be relied upon but there was very little difference between the objective and subjective findings after treatment. The psychic effect of treatment did not seem to influence the results.

The best results were obtained in rheumatoid arthritis of the spine, where slight improvement occurred in 34 per cent, moderate in 37 per cent, and marked in 12 per cent. Those not improved showed ankylosis and deformities. In rheumatoid arthritis without spondylitis improvement was slight in 26 per cent, moderate in 61 per cent, and marked in 35 per cent. The poorest results were in osteoarthritis, where improvement was slight in 29 per cent, moderate in 40 per cent, and marked in 16 per cent.

If one course of treatment was not effective in relieving the arthritic complaint, repetition of the treatment was not indicated, since it rarely produced any relief of pain. Faulty selection of patients was usually attributed as the chief cause of failure. Severe articular derangement and spur formation seemed to be a contraindication to irradiation as were also serious systemic disease and infection.

In some patients pigmentation of the skin occurred; in others nausea and vomiting followed treatment, and quite frequently there was an exacerbation of symptoms twelve to twenty-four hours after irradiation. Amenorrhea occurred in several patients in whom the lower spine was irradiated. Leukopenia was an occasional reaction.

Irradiation of arthritic joints seems to have a definite place in the treatment of arthritis but should not be used to the exclusion of other accepted procedures, and the patients should be well selected. Follow-up films of the irradiated joints fail to show any appreciable change as a result of treatment.

JOHN B. MCANENY, M.D.

Treatment of Peritendinitis Calcarea of the Shoulder Joint by Roentgen Irradiation: Report of One Hundred Cases. I. Klein. Am. J. Roentgenol. **56:** 366–375, September 1946.

One hundred cases of peritendinitis calcarea of the shoulder joint were divided into three groups: acute (duration under a month), subacute (two months duration), and chronic (over two months). Roentgen therapy was applied anteriorly and posteriorly over a period of seven to fourteen days, the treatments averaging 125 r. The factors varied from 125 to 200 kv., 5 to 7 ma., 30 to 40 cm. distance, with a 10 by 15 cm. cone. Acute cases were usually given one course of treatment. Subacute and chronic cases generally received more than one course. The acute cases responded with improvement in seven days, and 69 per cent showed partial to complete resolution of the calcification after treatment. In the subacute cases, the disability period was longer, lasting an average of twenty-six days; 36 per cent of these cases showed a reduction in the calcification after treatment. The chronic cases had a disability period of thirty-six days, and there was reduction in the calcification in 32 per cent of this group.

In those cases of peritendinitis in which calcification is bone-like, it is impossible to reduce it with roentgen therapy. Those acute cases which showed no calcification were treated in the same manner as the other acute cases and were completely relieved. As the response of the acute cases is so much more satisfactory, an effort should be made to treat cases of peritendinitis calcarea as soon as possible. Illustrative case histories are presented. CLARENCE E. WEAVER, M.D.

Reticulo-Endotheliosis, with Report of Two Cases. Allison E. Imler. Am. J. Roentgenol. **56:** 343–354, September 1946.

Single or multiple granulomatous lesions of bone have been variously classified as certain forms of xanthomatosis, Hand-Schüller-Christian's disease, Letterer-Siwe's disease, lipoid histiocytosis, lipoidosis, lipoid granulomatosis, eosinophilic granuloma, solitary granuloma, and reticulo-endotheliosis. The clinical signs are dependent on the location of the granulomatous masses. Headaches and localized areas of scalp tenderness are two of the most common findings. Diabetes insipidus is a result of granulomatous infiltration of the hypophysis and tuber cinereum. Pulmonary involvement has been frequently reported. Xanthomatous infiltration may simulate a mastoiditis. Exophthalmos may occur. Recently it has been found that this disease is not confined to childhood.

The bone defects are not due to a disturbance of the calcium metabolism but to pressure from the granulomatous masses. Most of the reported skeletal defects have been in the skull, pelvis, femora, and ribs. Nearly all of the fatal cases have shown extensive involvement of the lungs. Diseases to be differentiated are multiple myeloma, chronic osteomyelitis, cholesteatoma, osteoporosis circumscripta, tuberculous osteomyelitis, syphilitic osteomyelitis, and metastatic carcinoma.

Satisfactory response of the bone, pituitary, and pulmonary lesions can be obtained with relatively small doses of roentgen radiation. None of the skull lesions in the author's reported cases received more than 400 r measured in air, through any one field.

It is believed that all the diseases mentioned in the first paragraph of this abstract are variants of a hyperplastic reaction of the reticulo-endothelial system and can be properly grouped under the term reticulo-endotheliosis. There are insufficient data to support the claim of a lipoid metabolic disorder as a primary causative factor. Complete reports of two cases are given, with roentgenograms showing bone involvement in the skull, femur, pelvis, and mandible, and pulmonary infiltration and fibrosis, and illustrating response to roentgen therapy. CLARENCE E. WEAVER, M.D.

TECHNIC

A Device of Value for Roentgen Ray Epilation. Oscar L. Levin and Howard T. Behrman. Arch. Dermat. & Syph. **54:** 200–201, August 1946.

The authors describe, with an illustration, a device which they have found useful in centering the fields for x-ray epilation for tinea capitis. It consists of a flat piece of metal the size of a large treatment cone which can easily be attached to the cone by small knobs. In the center of the plate is fixed a pointer of such length that when it touches an object the T.S.D. is exactly 20 cm. JOSEPH T. DANZER, M.D.

A Note on Radiography as an Aid to Beam Direction in Radiotherapy. H. G. Davies and M. Halberstaedter. Brit. J. Radiol. **19:** 326–328, August 1946.

The use of radiography for checking the direction of the beam in x-ray therapy is advocated. This is particularly useful in obese and deformed patients and when radiation must be given through a cast. A kilovoltage of 110 is advocated as a suitable value. A graph is given by means of which the exposure time may be determined from the thickness of the patient and the area of the field. SYDNEY J. HAWLEY, M.D.

EFFECTS OF RADIATION

Irradiation Sickness: Histamine Effect Treated with Benadryl; A Preliminary Report. J. E. Lofstrom and C. E. Nurnberger. Am. J. Roentgenol. **56:** 211–219, August 1946.

Relief of severe symptoms of irradiation sickness in 19 cases by administration of benadryl (beta-dimethylamino-ethyl benzhydryl ether hydrochloride) is reported by the authors. The complaints of anorexia, nausea, vomiting, weakness, and headache were used as an index of the efficacy of the drug.

For intravenous injection, 5 to 10 c.c. (50 mg. to 100 mg.) of benadryl was given. Patients thus treated experienced a side reaction consisting of dizziness, unsteady motion, weakness, and drowsiness lasting for one to four hours. Later a general feeling of well-being developed. In 7 cases benadryl was given by mouth only, in the form of 50 mg. capsules, one every four hours during the day. These patients showed no marked side reactions, and satisfactory relief was obtained in most cases.

The causes of irradiation sickness are unknown. There is evidence to suggest that histamine-like bodies are developed in the blood of the patient subjected to roentgen therapy, and the relief afforded by benadryl may be the result of its antihistamine action.

H. H. WRIGHT, M.D.

Repair of Vesicovaginal Fistula Caused by Radiation. Gray H. Twombly and Victor F. Marshall. Surg., Gynec. & Obst. **83:** 348–354, September 1946.

Repair of vesicovaginal fistulas in heavily irradiated tissues is peculiarly difficult because the local blood supply is precarious, the tissues are inelastic and fixed, and are so fibrotic as to make dissection, particularly of flaps, quite difficult. Also, the frequent intimate association of the ureteral orifices adds to the problem. The authors of this paper are therefore particularly to be congratulated on the introduction of the method which they describe here. While the principle of repair is not original, the procedure itself is believed to be new. It is applicable in those cases of fistula where the uterus has been entirely removed or where the uterus has atrophied and the cervix has been destroyed.

The procedure is described in detail and three cases are reported in which complete success was obtained though they had been regarded as irreparable. In each instance there was resultant vaginal shortening, but all the patients reported repeated successful sexual intercourse following the operation.

Repair is accomplished by using a portion of the posterior vaginal wall and by use of constant "low-pressure bubble suction" through a cystostomy made well away from the repair site in the dome of the bladder. The method involves a generous suprapubic cystostomy. The posterior vaginal wall is then fitted into the bladder defect by means of pressure through the rectum. The necessary area of vaginal mucosa is visualized and marked and a vaginal approach is then used. The anterior vaginal wall is then separated in its deepest portion and the posterior vaginal wall is separated in most of its deepest portion, excluding the donor site. By returning to the suprapubic incision and suturing the good bladder wall to the posterior vagina (staying about 1 cm. away from the ischemic scarred margin of the bladder and using loosely applied sutures) the defect is closed. By then returning to the vagina the freed anterior wall and the remaining portion of the posterior wall are united. In this fashion there are two distinct suture lines in the repair and raw surfaces are generously approximated. An important part of the treatment is the applying of constant low-pressure suction through a very high cystostomy tube, thus eliminating a urethral catheter near the site of repair. It is readily apparent that, if the ureter is present in the fistula, its function would not be impaired. The authors advise placing the patient in a prone position postoperatively for two weeks or more.

JAMES C. KATTERJOHN, M.D.

Controlled Nuclear Energy: Its Attendant Hazards and Benefits. Andrew H. Dowdy. Occupational Med. **2:** 126–231, August 1946.

The author considers the hazards of nuclear energy as threefold. In the first place, there are the hazards of production, which are mainly those related to exposure to free radiations and dust laden with radioactive and non-radioactive chemicals. The principal dangers to be anticipated from external radiation are those attributable to exposure to neutrons and gamma rays. These affect especially the blood-forming organs and the reproductive cells of the ovaries and testes, leading to temporary or permanent sterilization and possible effects on future offspring. The hemopoietic and reproductive systems may also suffer from the effects of internal radiation due to the inhalation, absorption, or ingestion of radioactive dusts and fission products. To these hazards is added the possible production of cancer as the result of prolonged exposure to excessive amounts of radioactive dusts.

A second danger is that incident to the use of nuclear energy as a destructive force, as in the bombings of Hiroshima and Nagasaki. In these bombings the radiation injuries in general resulted from the tremendous release of nuclear energy in the form of neutrons, gamma rays, and radioactive fission products at the moment of explosion. Radiation accounted for about 5 per cent of the fatalities in both bombings. Contrary to various reports, there was no significant or persistent induced radioactive material in and around the two cities as a result of the bomb explosion.

The great constructive possibilities of controlled nuclear energy lie in the production of radioactive and heavy isotopes for research in the basic sciences, with consequent increase in the understanding of such problems as normal growth, the aging process, degenerative diseases, and the pharmacology of drugs and biological products. Failure on the part of Congress to sponsor a national program directed to the utilization of controlled nuclear energy for industrial and scientific purposes and the stifling of such a program by too narrow a field of vision or too rigid security regulations constitute the third hazard mentioned by the author.

EXPERIMENTAL STUDIES

Effect of Pulmonary Resuscitative Procedures upon the Circulation as Demonstrated by the Use of Radioactive Sodium. Samuel A. Thompson, Edith H. Quimby, and Beverly C. Smith. Surg., Gynec. & Obst. **83:** 387–391, September 1946.

In pulmonary resuscitative measures one must not merely consider oxygenation of pulmonary blood but also the movement of such blood to vital centers, especially when the circulation has stopped. The relative effects of various types of pulmonary resuscitation upon the circulation were determined by the use of radioactive sodium introduced into the circulation of a dog immediately after death by asphyxiation.

The sodium was made radioactive by deuteron bombardment in the cyclotron. Two cubic centimeters of normal saline containing 50 to 60 microcuries of the sodium were injected into the femoral vein and artery after death. A Geiger-Müller counter registered the movement of the blood containing the tracer. Heparin was previously injected to prevent clotting.

The methods of resuscitation were (1) double action respirator, exerting positive and negative pressure, (2) suction only, and (3) pressure only. Their value in producing circulation was in the same respective order in descending efficiency. The number of dogs used was small, being only 7.

The authors conclude that, of the methods tested, alternate positive and negative pressure provides the best circulation of blood, though slow. Heparin is considered of value in resuscitation by preventing clotting which would hamper or stop circulation.

ARTHUR W. PRYDE, M.D.

July 1947

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